WATER WORKS & SEWERAGE

EXPERIMENTAL TANKS
IN BALTIMORE'S CATHODIC PROTECTION STUDIES

Liquid chlorine is an *essential* war material. Tremendous quantities are called for—to fill many urgent, *vital* war demands. To meet our obligations in emergency war orders and public health needs, we have expanded our production. But the supply for many normal uses is still strictly limited.

By efficient handling of chlorine for civilian needs, you can aid directly in the great national war effort. You can cooperate further by returning empty chlorine cylinders promptly.

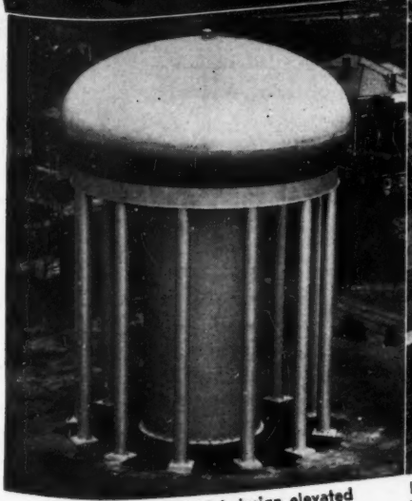
CHEMISTRY
IS THE KEYSTONE
OF INDUSTRY

PENNSYLVANIA SALT
MANUFACTURING COMPANY
1850 *Chemicals* 1942

1000 WIDENER BUILDING, PHILADELPHIA

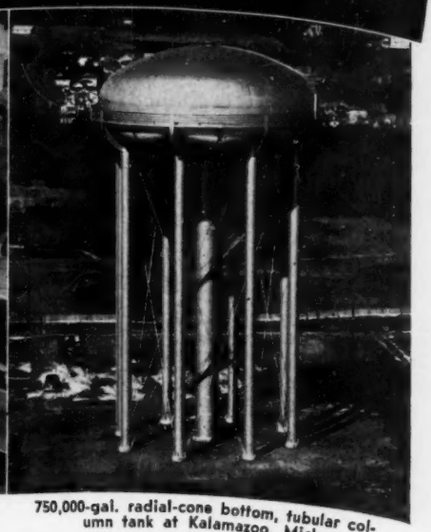
BRANCH OFFICES: NEW YORK • CHICAGO • ST. LOUIS • PITTSBURGH • WYANDOTTE • TACOMA
PLANTS: PHILADELPHIA • EASTON • NATRONA • WYANDOTTE • TACOMA • PORTLAND, ORE.

HORTON ELEVATED WATER TANKS



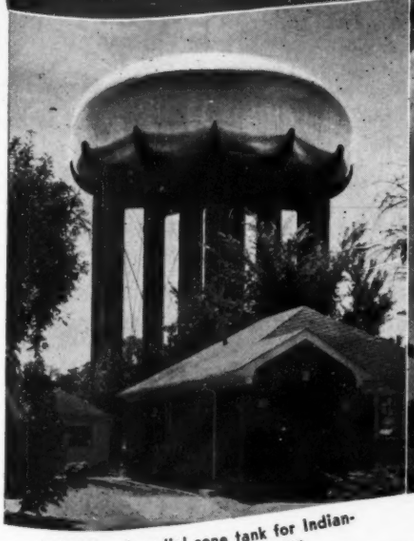
1,000,000-gal. spheroidal design elevated tank at Jonesboro, Ark.

100,000-gal. Watersphere, 100 ft. to bottom, installed in the Monon, Ind., water supply system.

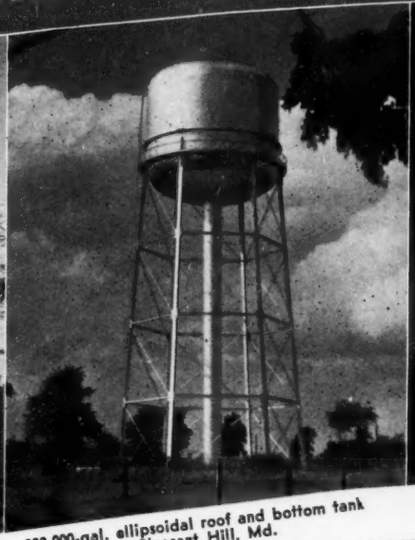


750,000-gal. radial-cone bottom, tubular column tank at Kalamazoo, Mich.

offer DEPENDABLE-LOW COST Service



1,500,000-gal. radial-cone tank for Indianapolis (Ind.) Water Company



300,000-gal. ellipsoidal roof and bottom tank at Pleasant Hill, Md.

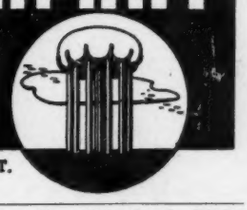
1,000,000-gal. tank at Tucson, Ariz.

plus MODERN-DISTINCTIVE Design

• Write for this illustrated booklet which shows sizes and architectural treatments available in Horton radial-cone bottom tanks.

CHICAGO BRIDGE & IRON COMPANY

Chicago.....2193 McCormick Bldg.	Birmingham..1586 North 50th Street	Philadelphia...1644-1700 Walnut St.
New York.3390-165 Broadway Bldg.	Tulsa.....1646 Hunt Bldg.	Washington...632 Washington Bldg.
Cleveland.....2262 Guildhall Bldg.	Houston.....5615 Clinton Drive	San Francisco.....1033 Rialto Bldg.
Havana.....402 Edificio Abreu	Detroit.....1551 Lafayette Bldg.	Greenville.....York Street



Plants at BIRMINGHAM, CHICAGO, *and* GREENVILLE, PA. *In Canada:* HORTON STEEL WORKS, LIMITED, FORT ERIE, ONT.

WATER WORKS & SEWERAGE, July, 1942. Volume 89. Number 7. Published monthly by Gillette Publishing Co., 330 South Wells Street, Chicago, Ill. Per copy, 25c. Subscription rate, United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under Act of March 3, 1879.

THREE OFFERS AND A PROPOSAL

FIRST OFFER: If you operate *any kind* of equipment made of aluminum and you are baffled in any way in maintaining it in top condition—give us the facts, and we will rush you our recommendations.

We are busy making more millions of pounds a month than we made in a whole year, not so long ago—but not too busy to make sure that no single pound of aluminum at work anywhere on war effort shall fail to do its share of making whatever it takes to win.

SECOND OFFER: If you are making anything whatsoever out of aluminum, and are stumped in any way in setting up the best methods of fabricating it—give us the facts, and we will see that you get all the know-how in our power.

THIRD OFFER: If you have joined the host of those who believe that industry must even now be planning the new products that will make jobs when this thing is finally over; if you are letting your imagination soar: Won't you ask us to help you engineer it down to earth with all the up-to-date facts about Alcoa Aluminum, plus some of the very practical dreams we have been dreaming?

AND THE PROPOSAL: Do some personal Imagineering, right now, for the sake of your own personal tomorrow.

IMAGINEERING

We have been talking Imagineering for some months largely in terms of the future. And in terms of industry. But here is the personal slant:

Thirty billion dollars is loose in the country. It is the gap between what is available for spending and what is available for personal purchases. Each of us has a sliver of that chunk of excess purchasing power.

If we put it into War Bonds, we are told that it will both finance the war, and avoid inflation. We sometimes forget that it will also finance ourselves, as users of goods, to buy the new products we are all readying, as makers of goods. Buying tomorrow, today, is patriotism and sense—business sense.

Aluminum Company of America, 1955 Gulf Bldg., Pittsburgh, Pa.

SO MUCH SO SOON

ALCOA ALUMINUM

YOU CAN USE LEAD

FOR SERVICE PIPES AND CALKING

Lead pipe and calking lead stamped with the "Seal of Approval" meet the Standards of the Lead Industries Association which are currently identical in substance with those of the National Bureau of Standards. Insist on this Seal on the lead you buy for dependable quality.

If you are not receiving our helpful free magazine, LEAD, write for your copy and keep up with the latest developments in lead.

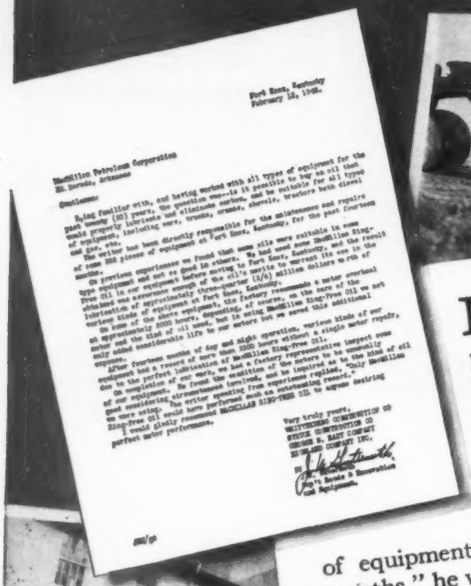
No government order now prohibits you from using lead for water service pipe or for calking joints on mains. This is because lead is in sufficient supply so that all military requirements are being met promptly and enough lead remains for many civilian purposes, particularly for such essential industries as water distribution.

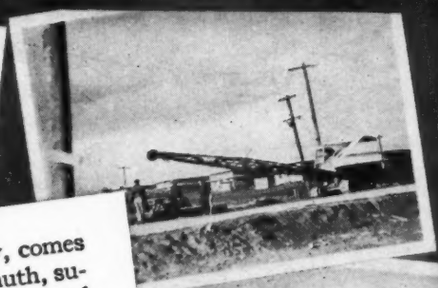
Water works which have used lead need not look for a substitute for this time-tested material; others can use lead to solve their critical material problems.

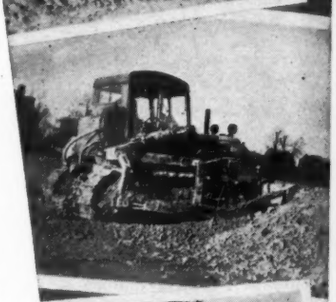
LEAD INDUSTRIES ASSOCIATION
420 LEXINGTON AVENUE, NEW YORK, N. Y.
YOU'RE MONEY AHEAD WHEN YOU WORK WITH LEAD

"An outstanding record" on 385 pieces of equipment

CARS • TRUCKS • CRANES • SHOVELS • DIESEL AND GAS TRACTORS







FROM FORT KNOX, Kentucky, comes a letter from J. W. Gutermuth, superintendent Roads and Excavation and Equipment for Whittenberg Construction Company, Struck Construction Company, George M. Eady Company, and Highland Company, Inc. He "has been directly responsible for the maintenance and repairs of some 385 pieces of equipment at Fort Knox for the past fourteen months," he writes in February, 1942.

In previous jobs, he says, some oils were good in some types of equipment "and not so good in others." His experience with Macmillan RING-FREE was reason enough for him to use it on $750,000 worth of equipment at Fort Knox.

On some of this equipment, the factory recommends overhauls at about 2,000 hours. But—

"After fourteen months of day and night operation," continues Mr. Gutermuth, "various kinds of our equipment had a record of more than 3,300 hours without a single motor repair, due to the perfect lubrication of Macmillan RING-FREE Oil."

When a factory representative inquired what oil had been used, Mr. Gutermuth replied:

"Only Macmillan RING-FREE Oil could have performed such an outstanding record.'

Whatever your equipment may be, write us, so that Macmillan RING-FREE can do for you what it is doing for others.

• • •

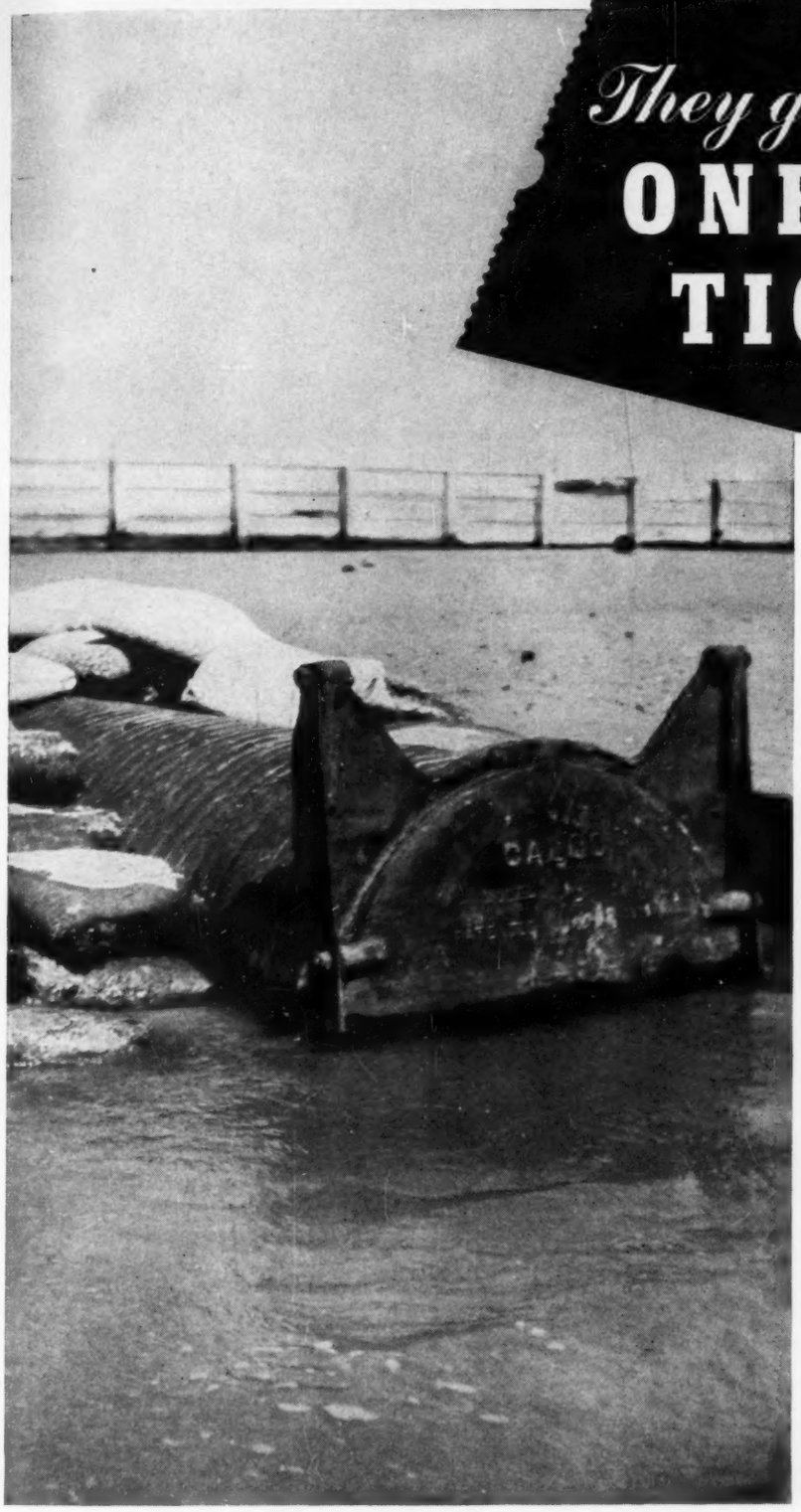
MACMILLAN PETROLEUM CORPORATION

50 West 50th St., New York
624 S. Michigan Ave., Chicago
530 West 6th St., Los Angeles

MACMILLAN RING-FREE MOTOR OIL

Copyright 1942 by Macmillan Petroleum Corporation

"No admittance"! These gates close up tight when backflow threatens. Under other conditions they permit free, easy outflow.



They give water a ONE-WAY TICKET

Calco-Hardesty Gates have "gone to war" along with most other metal products. Now they may be obtained only for important war projects where they are needed to eliminate the danger of high water flooding valuable property.

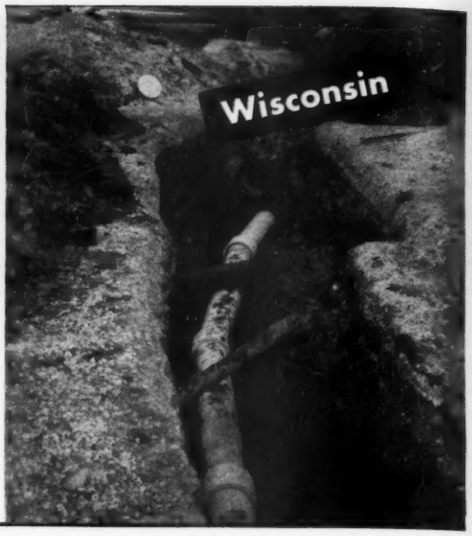
In war as in peace these gates are ideal for drainage, flood control, sewer outfalls and wherever else backwater is a hazard. They are easily installed on any type of drainage construction by unskilled labor.

There is a size and type of gate to meet every requirement. These include automatic drainage gates that open and close without power or supervision; light- and heavy-duty slide gates; and automatic radial gates to keep water levels constant.

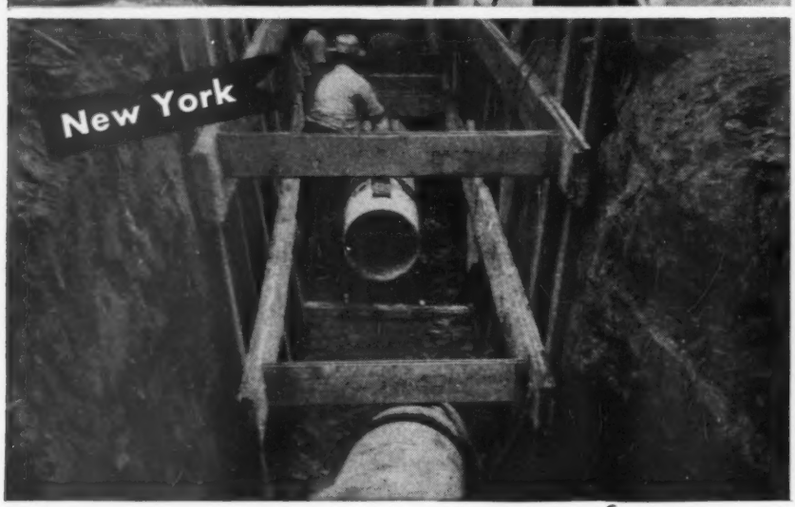
After the war Calco-Hardesty Gates will again be available to help protect valuable civilian property. Meanwhile write us for data regarding important war construction. The ARMCO DRAINAGE PRODUCTS ASSOCIATION, 535 Curtis Street, Middletown, Ohio.

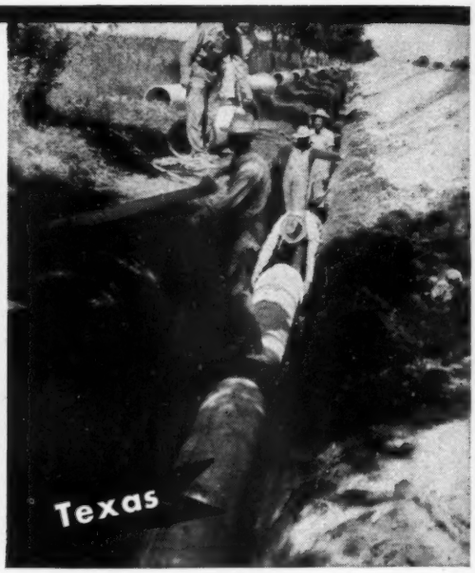
ARMCO

CALCO-HARDESTY GATES



From Coast





For Water Lines

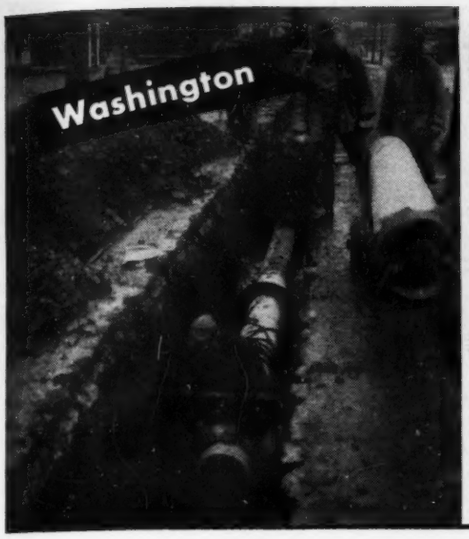
In hundreds of cities, towns and villages, J-M Transite Pipe is contributing to efficient, low-cost water transportation. Here are some of the reasons why . . .

Rapid Assembly—The Simplex Coupling means rapid, economical assembly, even by unskilled crews. Joints are assembled cold, without heating or pouring.

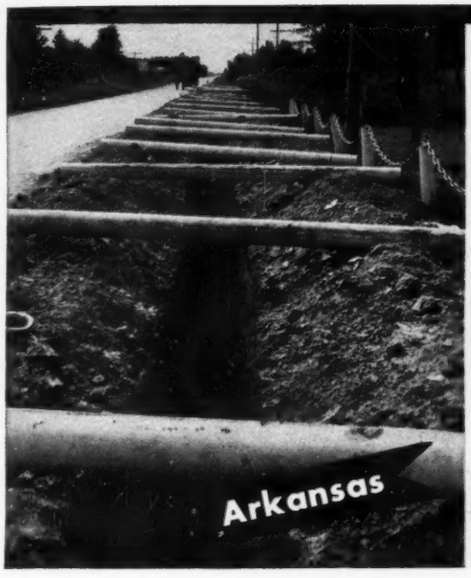
Easy Handling—Transite Pipe is unusually light in weight. Mechanical loading and unloading equipment is needed only for the larger sizes.

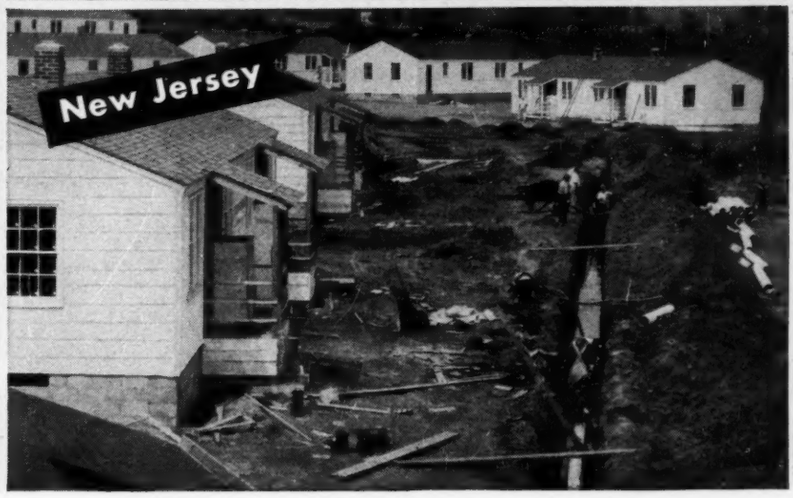
Tight, Flexible Joints—Consisting of a Transite sleeve and two rubber rings, Simplex Couplings provide tight, flexible joints. Finished joints are checked merely by gauging the position of the rings. The Simplex Coupling allows deflections up to 5° at each joint, permitting wide sweeps to be made with straight lengths of Transite.

JOHNS-MANVILLE JM PRODUCTS



to Coast





No Tuberculation—because Transite is of non-metallic, asbestos-cement composition. Tubercles can never reduce its high flow coefficient (C=140).

Low Maintenance—Transite's asbestos-cement composition also means high corrosion-resistance. This advantage, plus lasting tight joints, contributes to Transite's low maintenance costs.

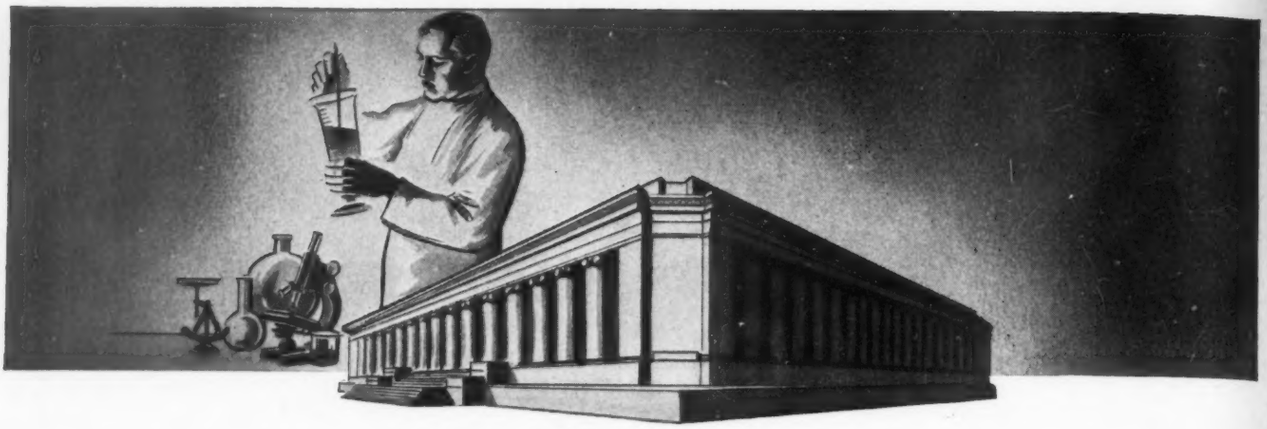
• • •

For complete details on Transite Pressure Pipe, send for brochure TR-11A. And for facts on reducing sewage disposal costs with Transite Sewer Pipe, write for brochure TR-21A. Johns-Manville, 22 East 40th Street, New York, N. Y.

Johns-Manville Transite Pipe

AN ASBESTOS PRODUCT

For efficient, economical water and sewer lines



Research....

KEYSTONE OF

PITTSBURGH-DES MOINES' PROGRESS

The program of engineering research maintained by the Pittsburgh-Des Moines Steel Company over the years, now culminates in the establishment of a Multiple Fellowship on Chemical Containers and Storage at the Mellon Institute of Industrial Research.

Utilizing the unlimited scientific resources of the Institute, the Fellowship will conduct research on the problems connected with bulk storage of chemical substances, including water, oils, and gases.

At the present time, the Fellowship is working on vital problems connected with the storage of chemicals in the synthetic rubber industry, including butadiene, styrene, acrylonitrile, and isobutylene.

The general research conducted by the Pittsburgh-Des Moines Chemical Storage Fellowship will develop much new chemical and physical data available to our clients, in the form of reports and recommendations as to the most suitable types of containers, construction, temperatures, pressures, linings and coatings for the protection of the container and the substances for which bulk storage facilities are desired.

PITTSBURGH • DES MOINES STEEL CO.

PITTSBURGH, PA., 3418 NEVILLE ISLAND—DES MOINES, IOWA, 919 TUTTLE STREET

NEW YORK, ROOM 918, 270 BROADWAY • CHICAGO, 1222 FIRST NATIONAL BANK BUILDING

DALLAS, 1223 PRAETORIAN BUILDING • SAN FRANCISCO, 625 RIALTO BUILDING

SEATTLE, 1126 EIGHTH AVENUE, SOUTH

. . . BUT TIME LOST IS LOST FOREVER

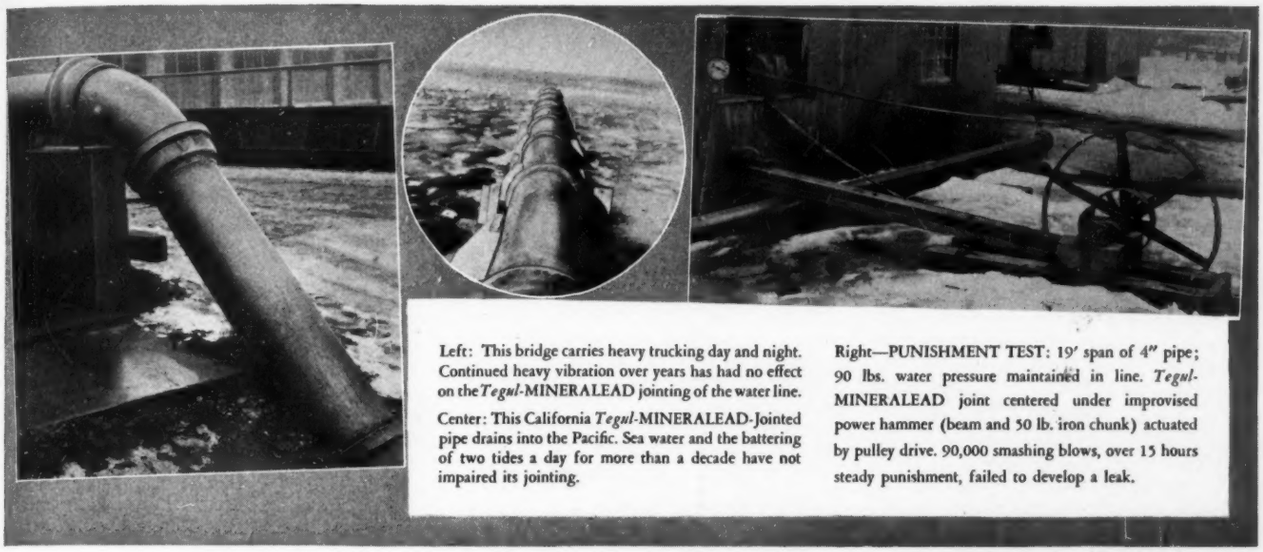
MATERIAL LOSSES MAY BE RECLAIMED

HOW THIS *DIFFERENT* JOINTING COMPOUND ~~SPEEDS UP~~ BELL & SPIGOT MAIN LAYING

In laying or repairing bell and spigot water lines, it was formerly believed necessary that the lines remain exposed until initial leakage ceased.

Such delays can now be avoided by using *Tegul*-MINERALEAD, a compound having a base of sulphur, plasticized with Thiokol (a synthetic rubber) which reduces initial leakage to far below that usually experienced, and also hastens sealing.

Thus, when *Tegul*-MINERALEAD is used, trenches may be back-filled at once, speeding the clearing up of traffic hazards and tidying up of premises.



Left: This bridge carries heavy trucking day and night. Continued heavy vibration over years has had no effect on the *Tegul*-MINERALEAD jointing of the water line.

Center: This California *Tegul*-MINERALEAD-Jointed pipe drains into the Pacific. Sea water and the battering of two tides a day for more than a decade have not impaired its jointing.

Right—PUNISHMENT TEST: 19′ span of 4″ pipe; 90 lbs. water pressure maintained in line. *Tegul*-MINERALEAD joint centered under improvised power hammer (beam and 50 lb. iron chunk) actuated by pulley drive. 90,000 smashing blows, over 15 hours steady punishment, failed to develop a leak.

MAKES TIGHT, STURDY, ENDURING JOINTS

Lines jointed with *Tegul*-MINERALEAD have served for years without trouble, even where subjected to constant vibration from railroad and highway traffic and nearby heavy machinery.

Tegul-MINERALEAD joints are immune to acid ground conditions and have far above average resistance to thermal shock In lines carrying hot water, or water alternately hot and cold — in which other compounds have failed to stand up — *Tegul*-MINERALEAD is giving entire satisfaction

SIMPLIFIES HANDLING AND STORAGE

Tegul-MINERALEAD comes in 10 lb. ingots, packed five to carton, easy for your workmen to handle and convenient to store. Only one-fifth the weight of lead, *Tegul*-MINERALEAD is also economical to ship. It melts without sediment, pours and settles quickly, requires no caulking, deep bell holes or skilled labor

Impervious to moisture, the ingot can be stored outdoors unprotected in all weathers. A further important advantage is that, properly mixed at our plant, *Tegul*-MINERALEAD cannot change its composition en route to point of use

CONSERVES STRATEGIC WAR METAL

We have yet to hear of a *Tegul*-MINERALEAD user who would willingly return to lead for jointing purposes. Also lead is now a strategic metal and should be conserved for the important part it is playing in the war program. *Tegul*-MINERALEAD is quickly available from stocks carried at central locations throughout the country.

Write us here at Mertztown, for technical literature. Or address our nearest branch listed below.

Tegul-MINERALEAD

THE ATLAS MINERAL PRODUCTS CO OF PA — The House of Jointing Materials — MERTZTOWN PA EST 1892

THE **Atlas Mineral** PRODUCTS COMPANY OF PENNA. MERTZTOWN, PENNSYLVANIA

*ATLANTA, Georgia
175 Spring St., S. W.

*CHICAGO, Illinois
333 N. Michigan Ave.

*DALLAS, Texas
3921 Purdue Street

*DETROIT, Michigan
2970 W. Grand Blvd.

*KANSAS CITY, Kansas
1913 Tauromee Ave.

NEW YORK CITY
280 Madison Ave.

PITTSBURGH, (10) Pa.
4656 Old Boston Rd.

TORONTO, Ontario
McRae Engineering Equipment, Ltd.
11 King Street, West

*DENVER, Colorado
1921 Blake Street

The ATLAS MINERAL PRODUCTS Company of CALIFORNIA — Redwood City, California

*HONOLULU, Hawaii, U.S.A.
Lewers & Cooke, Ltd.

*LOS ANGELES, Calif.
817 Yale Street

*SEATTLE, H. D. Fowler Company
558 First Avenue, South

Stocks carried at these points

How We Increased Plant Capacity 50%...WITHOUT Adding to Our Settling Capacity

BY LAWRENCE L. LUTHER

Commissioner of Sanitation, Village of Freeport, N. Y.

MANY a community where the war brought large increases in population is being abruptly faced these days with a pressing need for additional sewage plant capacity. Yet extensive plant additions, with the present shortages of materials, are often impractical or downright impossible.

To sanitation officials faced with that dilemma, here is the story of how we studied and eventually solved much the same problem six years ago in this fast-growing, residential community on Long Island.

Our present sewage treatment plant was designed in 1926 with a designed capacity of 1,000,000 gallons a day. When it was placed in operation in 1929, it served a connected population of 2,500, receiving a daily flow of about half a million gallons. By 1934, however, the connected population had grown so rapidly that the daily flow was already exceeding plant capacity.

To find some way of meeting this problem without adding too much to our already substantial capital investment, we started a thorough study of the possibilities of chemical coagulation. New developments in chemicals and methods of treatment had resulted in a re-birth of interest in chemical treatment, but there were, as yet, very little actual plant data to guide us.

THREE CHEMICALS STUDIED

In the course of our study we experimented with three different chemicals which we found to be effective and efficient coagulants for our purposes—ferric chloride, aluminum sulphate and Ferrisul (anhydrous ferric sulphate).

In all competitive tests on Freeport sewage, Ferrisul proved the most satisfactory material on a performance basis.

In addition to its value as a coagulant, Ferrisul formed a dense, compact sludge in the digesters. The hydrated ferric oxide floc also acted as a controller of hydrogen sulfide, thereby reducing odors in the primary tanks as well as reducing the sulfide concentration in the digesters,—an important point since it is well known that the toxicity of even limited quantities of hydrogen sulfide can greatly affect the rate of digestion.

TEST RESULTS TABULATED

As for comparative costs, the data below on a controlled test made during November and December of 1938 is typical. During two successive weeks Ferric and aluminum sulphate were fed *on an equal cost basis* and 24-hour composite samples were collected on identical days. Ferrisul, as compared with the aluminum sulphate produced:

7% increase in volatile solids reduction
8% increase in suspended solids reduction
1% increase in turbidity reduction
4% increase in settleable solids reduction
2% increase in B. O. D. reduction

As manufacturing facilities and consumption of Ferrisul have increased, prices have dropped to less than 65% of the 1936 level, thus increasing its usefulness still further and fully confirming our original choice.

One further test indicates the reductions derived from Ferrisul treatment over and above those from sedimentation alone. Daily 24-hour composite samples were taken during a period of usual chemical dosing and compared with a set taken during a similar period when no chemicals were used. Based on averages of several days, Ferrisul produced:

33% increase in volatile solids reduction
43% increase in suspended solids reduction
41% increase in turbidity reduction
105% increase in B. O. D. reduction

The conclusion of our studies: by chemical coagulation an effluent of higher quality could be produced, and, most important of all, the capacity of our existing sedimentation facilities could be substantially extended.

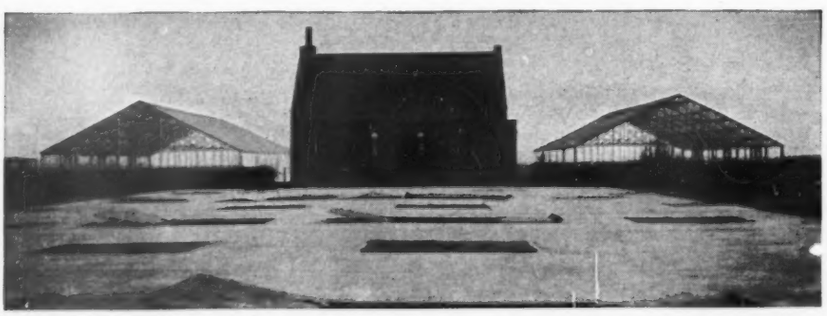
The result: since adopting Ferrisul treatment those original facilities continued to serve adequately until last year when our connected population reached 15,000 and our daily flow averaged 1,500,000 gallons a day—*50% more than the plant was originally designed to handle!*

CAN FERRISUL HELP SOLVE *YOUR* WARTIME PROBLEMS?

In many water and sewage plants facing many different problems Ferrisul is helping to maintain efficient, effective operations . . . in some cases where greatly increased wartime loads are straining plants even beyond their designed capacity . . . in others where wartime shortages of construction materials have delayed badly needed modernization programs. Dry and free-flowing Ferrisul is easy to handle and store, will not cake in storage and requires no expensive equipment for proper application. For details on Monsanto's extensive line of water treating chemicals and experienced technical advice on your water or sewage treating problems, inquire: MONSANTO CHEMICAL COMPANY, Merrimac Division, Everett Station, Boston, Massachusetts.

FERRISUL
for better, more efficient water and sewage treatment

MONSANTO CHEMICALS
SERVING INDUSTRY...WHICH SERVES MANKIND



This is the Freeport plant. When Ferrisul treatment was started some additions and changes in sludge handling facilities were necessary and this year it has finally become necessary to enlarge the settling facilities. Thanks to the 50% increase in settling capacity gained with Ferrisul treatment, however, it was possible to postpone that substantial addition to capital investment six years.

QUICK FACTS ON TRANSITE SEWER PIPE

FAST INSTALLATION . . .

Transite's long lengths reduce the number of joints needed in the line . . . its light weight permits easier, faster, more economical handling.

LESS INFILTRATION . . .

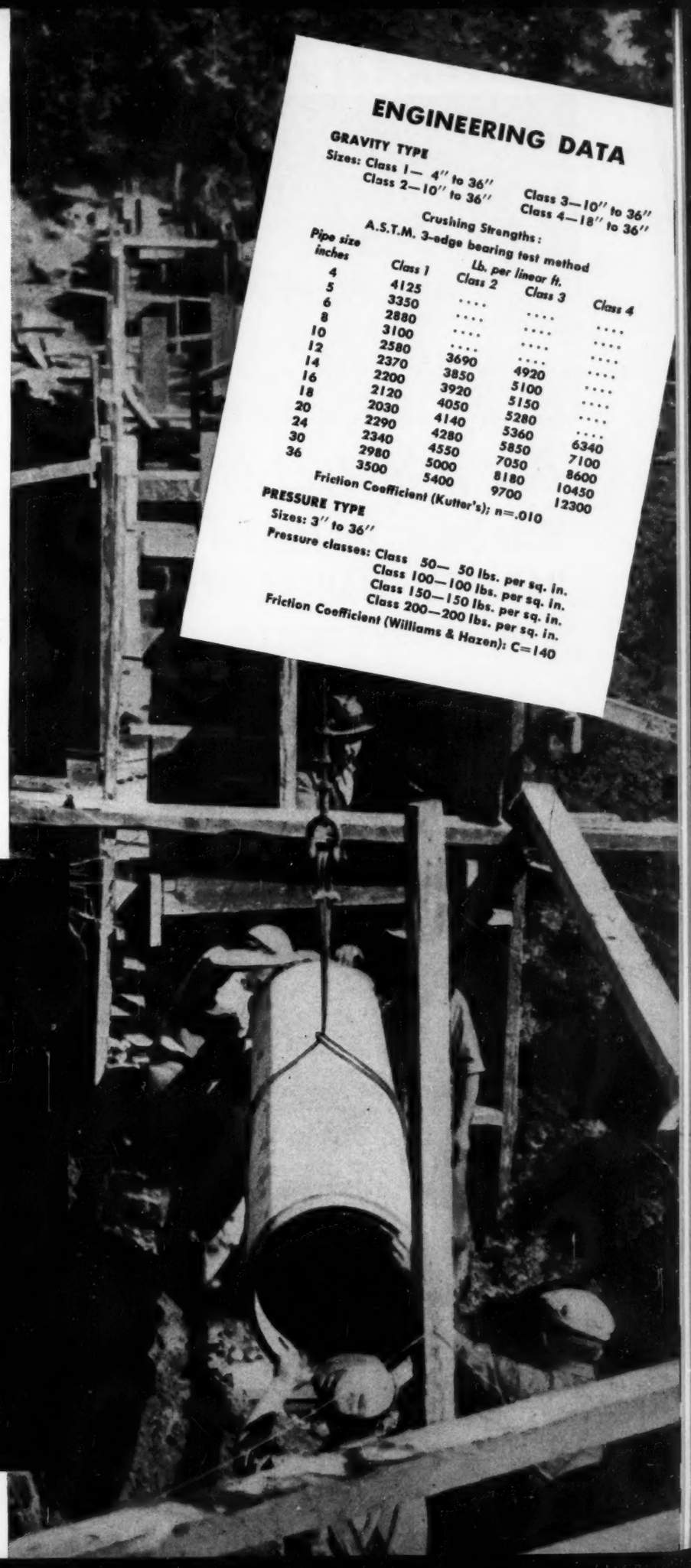
Fewer, tighter joints minimize leakage, cutting down on the load at the disposal plant.

HIGH DELIVERY CAPACITY . . .

This advantage of Transite Pipe frequently permits smaller pipe or flatter grades, resulting in shallower trenches.

AVAILABLE BOTH FOR FORCE MAINS AND GRAVITY LINES

Complete information is given in brochure TR-21A. And for details on lower-cost water transportation, send for Transite Water Pipe Brochure TR-11A. Johns-Manville, 22 East 40th Street, New York, N. Y.



ENGINEERING DATA

GRAVITY TYPE

Sizes: Class 1— 4" to 36"
Class 2—10" to 36"
Class 3—10" to 36"
Class 4—18" to 36"

Crushing Strengths:
A.S.T.M. 3-edge bearing test method

Pipe size inches	Lb. per linear ft.			
	Class 1	Class 2	Class 3	Class 4
4	4125	....	....	....
5	3350	....	....	....
6	2880	....	....	....
8	3100	....	....	....
10	2580	....	....	....
12	2370	3690	....	....
14	2200	3850	4920	....
16	2120	3920	5100	....
18	2030	4050	5150	....
20	2290	4140	5280	....
24	2340	4280	5360	....
30	2980	4550	5850	6340
36	3500	5000	7050	7100
		5400	8180	8600
			9700	10450
				12300

Friction Coefficient (Kutter's); n=.010

PRESSURE TYPE

Sizes: 3" to 36"

Pressure classes: Class 50— 50 lbs. per sq. in.
Class 100—100 lbs. per sq. in.
Class 150—150 lbs. per sq. in.
Class 200—200 lbs. per sq. in.

Friction Coefficient (Williams & Hazen): C=140

Johns-Manville

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An Asbestos Product

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More Dollars Per Man Per Month in the PAY-ROLL WAR SAVINGS PLAN

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WATER WORKS AND SEWERAGE

CUT YOUR MAINTENANCE COSTS WITH MUELLER BRASS GOODS

The usefulness of a curb stop or gooseneck depends upon how long it stays in the ground. Ripping up pavements and mutilating lawns is expensive and breeds a lot of trouble. One way to minimize these conditions is to use reliable brass goods.

MUELLER stops and goosenecks are well made, generously proportioned to resist strain, and accurately machined to prevent leaky keys. Every item must pass a rigid inspection and undergo a 200 pound hydraulic test. . . Once in the ground they can usually be forgotten for years. There will be no frequent digging up with the attendant increase in upkeep costs and consumer dissatisfaction.

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YOU NEED THIS TIMELY BULLETIN . . .

Emergency STERILIZATION EQUIPMENT

MODERN long range bomber warfare, with the latest in high explosives, has amply demonstrated its terrible effects. It is particularly significant that the best fortified cities in the world have been captured as a result of efforts to disrupt their water supplies. Enemies who have succeeded in shelling our shores and sunk our ships within sight of land may soon use long range bombers and acts of sabotage against our Water Works. Our enemies have brought the war to our shores—it has happened here! America's long complacency must go. Our eyes must open to the necessity of adequately protected water supplies with standby provisions for refitting a blasted system, including load proof Emergency Chlorination Equipment.

All water works, regardless of size, require certain common qualifications in Emergency Sterilization Equipment:

1. Simplicity—Designed so that ordinary people, not "specialists", can put the equipment into operation, adjust it, and make necessary minor repairs.
2. Safety—Elements of danger should be eliminated. Safe, easy-to-handle hypochlorites should be used in place of chlorine gas which is dangerous if amateur service men have to operate emergency chlorination equipment. Machines should be rugged, built to withstand concussion breakage from nearby bombings.
3. Capacity—Should be high, sufficient to handle most emergencies.
4. Moderate price—Every water works should have emergency equipment. The larger systems can afford fixed emergency equipment. The smaller systems can afford high capacity units to serial moderately priced, high capacity emergency equipment. The latter should be able to provide emergency sterilization at various places at the same time.
5. Flexibility—Equipment should be able to handle many future peacetime problems as well as present emergency problems.

%PROPORTIONEERS% ARE EMERGENCY STERILIZATION EQUIPMENT HEADQUARTERS!

5,000 Chlor-O-Feeders in water works, sewage plants, swimming pools, etc., in the last five years. Our emergency units have all the 5 qualifications listed above.

Dual Drive Chlor-O-Feeders are simple diaphragm or plunger pumps, mass production built through simplicity in construction and standardization of parts. "Proportioneers", have installed more than

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EMERGENCY CHEMICAL FEEDER HEADQUARTERS
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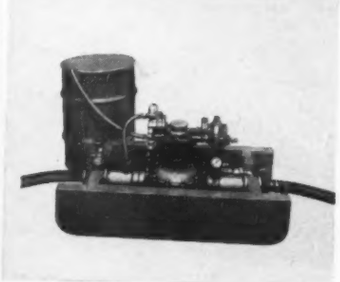
WHEN WRITING ASK FOR BULLETIN EMM

ADDRESS

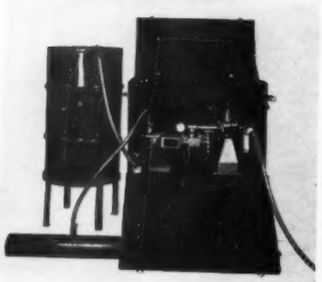
ABOUT EMERGENCY STERILIZATION EQUIPMENT

DUAL DRIVE CHLOR-O-FEEDER

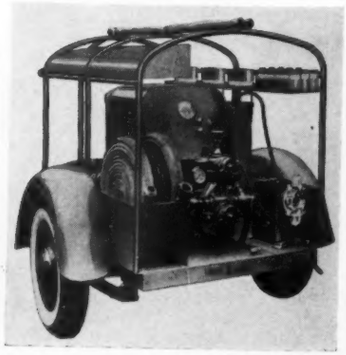
METER CONTROLLED MAIN STERILIZER



ALL HYDRAULIC CHLOR-O-FEEDER



THE BLITZ BUGGY



WATER WORKS & SEWERAGE

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COMING!

MEETINGS REPORTS

A.W.W.A's Conference on Wartime Water Works Problems and

Annual Meeting of the Central States Sewage Works Assn.

Reports of these two meetings, held late in June, will be printed in our August issue. Their delayed appearance is regretted, but it became necessary to make a decision not to run them rather than postpone other important and timely material.

It seemed to us that the address of J. A. Krug of the W. P. B. delivered at the A.W.W.A. Conference—**"War Production Policies and Water Works Practices"**—was about as important and timely in the sewage field as it is to waterworks managers, operation, maintenance and construction men as anything could well be, and that it should receive as wide and as immediate distribution as possible.

Then, also, from the President of A.W.W.A. there was Abel Wohman's stellar address on **"A Wartime Platform for A.W.W.A"**, which should appeal to those in the sewage field as well as in water supply practices for the duration. It was rated by us as another "must." Thus, the nine pages required for these two timely addresses of import, which had not been planned for, necessitated holding out the above reports scheduled for this issue.

As to other articles, given space this issue as having contexts of significance in furthering wartime practices in the water and sewage fields, we direct attention to those by E. E. Smith of Lima, Ohio, and A. M. Rawn of Los Angeles.—

L. E. H.

"Wartime Wage, Prices and Utilities Rates Control"

Is a recital of experiences in the Canadian Water Utility field with the Dominion's important wages and prices control acts as a wartime measure, which is most likely to be copied in the United States because of the success had with such control in Canada. Experiences of water works managers with the Canadian acts should prove of value to us at this time of contemplated legislation in the same direction. The Author—

ROSS L. DOBBIN, General Mgr.,
Utilities Comm. of Peterborough, Ont.
(Past Pres. & Honorary Member—A.W.W.A.)

"Gas Engine Operation and Performance"

Is the story of the performance record, dependability and economies of the gas engines of the medium sized sewage treatment works of Aurora, Ill. After a 15 month period of operation, experience has justified the complete severance of outside power. This step by step accomplishment represents another feather in the cap of the resourceful—

WALTER A. SPERRY, Sup't.,
The Sanitary District of Aurora, Ill.

"Metallizing"

Tells of the experiences of the Erie Water Department in putting to use this process of sprayed on molten metals to produce protective coatings, on other metal surfaces, to build up worn parts of machinery and save the need for replacements, repair of cracked parts, and other varied uses to which this very useful and flexible process has been put as a modern method in water works and sewerage maintenance. It is hardly necessary to add that in this period such methods of extending the service life of metal parts adds especial intent to the Erie experiences as told by the author, formerly of the Erie Water Dept.—

C. E. PALMER, President.
Palmer Filter Engineering Co. Erie, Pa.

"Experiences in Manganese Removal"

Will appear at a time when the seasonal manganese problem is just around the corner, so to speak, for many dealing with impounded and stored waters. At Durham, N. C. several methods have been tried in manganese trouble times, and the recital of experiences with ferric sulphate as the coagulant, in lieu of permanganate of potash, and the greater efficacy and economy of the ferric coagulation in conjunction with prechlorination should prove helpful to many operators. The author is—

ROBERT S. PHILLIPS, Chief Chemist,
Dep't. of Water and Sewerage, Durham, N. C.

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Waukesha Daily Freeman

An Independent Newspaper

Published every afternoon except Sunday by the FREEMAN PRINTING CO. 209-204 PARK PLACE

H. A. Youmans .....President and Editor

MONDAY, JANUARY 19, 1942.

Water Department: Lower Rates Plus Lower Cost

We appreciate the water department's operation most in times like these, when taxes are due. We shall appreciate it most in about two months from now when the man-sized bills from Uncle Sam and the state of Wisconsin become payable.

The water department is one city department which not only seeks no budgetary appropriation from the common council, but actually pays money in taxes. It has been doing this since 1931, so long that the yearly report of the commissioners, Henry E. Blair, J. G. Laing and Killian Weber, has become an old story.

From 1931 through 1941, the report for the last year points out, the utility paid $320,094.27 in cash to the city. This makes an annual payment of approximately $29,000. Inasmuch as the $20,000 appropriated every year from 1914 to 1930 is no longer required, and inasmuch as the department is turning over yearly in cash an average of about $29,000, the city is ahead $49,000. Spread over the tax roll, this amount is tantamount to a saving of $2.30 per $1,000 of assessed valuation. On top of that, it is noted that the water rates, lowered last January, plunged to the lowest point in this history of the plant.

Our city tax rate went down 20 cents this year, —a fine reduction. Yet, it could have been erased very easily had the water department's check, through all these years, failed to come forth.

Due in no small measure to special attention to water meters, Waukesha, Wisconsin, established the lowest water rates in the history of the City Water Works. For the $2 minimum quarterly charge, the customer can now use 8,000 gallons of water instead of 6,700 gallons.

Waukesha has a definite plan of testing and repairing water meters—testing meters when bought, testing when brought in for repairs, testing after repairs are made; with the emphasis on small flows. Repairs are made to bring ⅝" meters up to 95% or better on ¼ g.p.m. It costs only 24.2 cents per meter for materials on 229 meters which were in service an average of 73.5 months each before tests and repairs were made.

WATER WORKS & SEWERAGE

VOL. 89, No. 7 *A Gillette Publication* JULY, 1942

TESTS ON THE CATHODIC METHOD OF PROTECTING STEEL WATER TANKS

By GORDON L. O'BRIEN
Designing Engineer
Bureau of Water Supply
Baltimore Md.

IN THE early part of 1940 the Bureau of Water Supply became interested in the cathodic protection of their steel water tanks. The scant information that was available on this subject was gathered together, and it was found to be totally inadequate for a comprehensive study. Mr. Leon Small, Water Engineer, City of Baltimore, delegated the writer to conduct tests to determine the merits of this system.

The tests were started on October 24, 1940, and are still being conducted. One hundred and eighty-eight chemical analyses were made during these tests by the laboratory staff at Montebello Filters. The test tanks are located in the basement of the Druid Chlorinator Station and consist of three pieces of standard 10-inch wrought iron pipe, 3 feet long, with welded blank flanges in the bottom. Three ¼-inch nipple sampling taps were welded in the sides at various water levels, and water is admitted to the tanks at the rate of 177 c.c. per minute by means of a valved orifice. A drain hose is connected to the top nipple to lead away the overflow. The electrode for tank No. 1 is a 1-inch graphite rod, and for tank No. 2 it is a ¼-inch stainless steel rod. The electrodes are placed in the center of the 10-inch pipes and are held 3 inches from the bottom of the tank by the aid of ¼-inch thick masonite discs and

The Author

locknut placed at the top of the tank. The current is supplied by means of a rectifier unit ranging from 10 to 200 milliamperes at a potential of 6 to 60 volts, with suitable means of regulating the current to that desired.

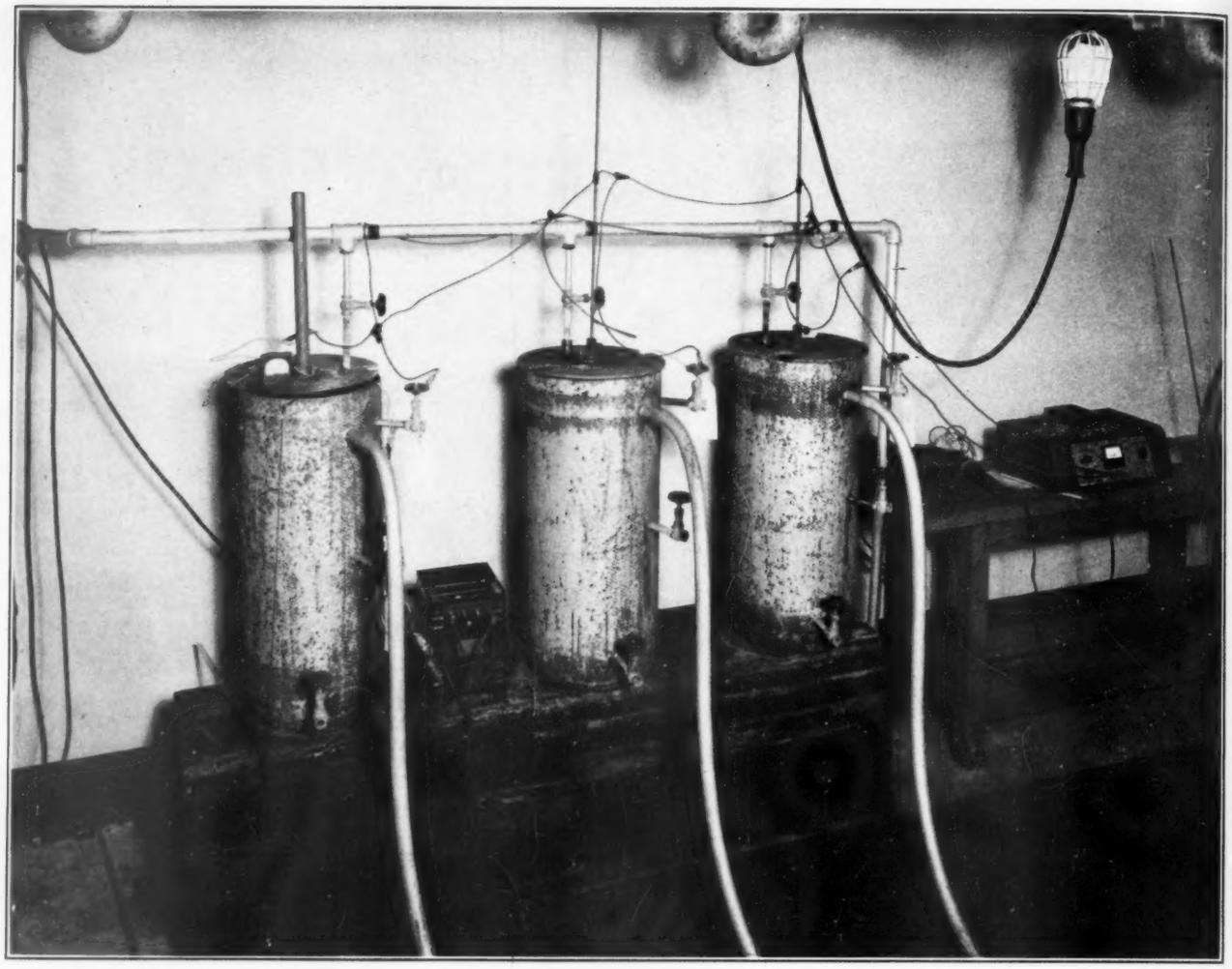
Tank No. 1 is arranged so that the negative terminal (cathode) of the rectifier is attached to the pipe or steel shell, and the positive terminal (anode) to the suspended electrode. Tank No. 2 has the connections reversed; that is, the tank shell or pipe is the anode or positive terminal. Tank No. 3 has no electrical connections, but it does have a stainless steel rod in the center in the event cathode protection study is desired. The purpose of this control tank is to study the normal corrosion of the shell under the same conditions as the cathodic protected tank.

Before proceeding to discuss the tests, it is well to review some simple electro-chemistry that governs the actions of this system.

Electro-Chemistry Governing Actions of System

If plates of pure zinc and copper are placed in pure distilled water, no corrosion takes place, but if the plates are connected externally with a conductor, a feeble current will be shown by a galvanometer if it is placed across the circuit. If a few drops of sulphuric acid are added to the water and the galvanometer is replaced by a voltmeter, an appreciable current will show with a potential of about 1.1 volts. The zinc plate will be eaten away while the copper plate will show no sign of corrosion. If an external electromotive force is applied to the copper plate in excess of the 1.1 volts and the connections are properly made, the zinc plate will be protected while the copper plate will be eaten away. In short, the cell becomes a copper plating unit instead of a current generating unit, which it normally is.

Now, if the zinc and copper plates are replaced with platinum plates and a current is passed through them, the solution will dissociate into its component parts and the plates will not corrode. The cathodic protection system works on the princi-



Cathodic Protection System Test Tanks
(From left to right, No. 1, 2, 3. For details see sketch.)

ple of the latter case. That is, the current decomposes the solution as the major process but takes with it a small increment of the electrode in so doing.

Water, as everyone knows, is composed of the elements hydrogen and oxygen chemically combined and can be regarded as HOH (H_2O). H means an atom of hydrogen, but if written H^+ it means that the atom carries a charge of positive electricity and is called a hydrogen ion. In the same way, OH^- stands for what is called the hydroxyl ion and carries a negative electrical charge. When these ions join, the positive and negative electrical charges neutralize each other, and the result is a molecule of neutral water (HOH), which is normally electrically inert. But in water, even if it be distilled and redistilled, not all of H^+ and OH^- ions are united. Some remain in the water as free ions, which, because of their electrical charges, are in such a state of motion that they exert a pressure against the walls of the container, or against whatever is in the water, in a manner similar to gas pressure. This separation of the ions is known as "dissociation."

It has been learned that pure distilled water contains something like I gram H^+ in 10,000,000 liters of water; hence, the amount of H^+ in pure water resulting from dissociation is 0.0001 part per million by weight. The number 10,000,000 may be written 10^7, 7 being the logarithm of 10,000,000. Pure water has a pH value of 7. The hydroxyl ion concentration of pure water is also 7, but we are not so much interested in this value as we are in the hydrogen ion, because it is this actively moving ion which aggressively attacks metals and causes them to pass into solution as ions of the metal.

$$Fe + 2H^+ = Fe^{++} + 2H$$

There may be hydrogen ions in water derived from other sources so that instead of 1 gram in every 10,000,000 liters there may be one in 100,000 liters; that is, pH = 5 instead of 7. The more H^+ there is, the lower the figure for pH.

"Hydrogen ion concentration" stands for acidity and "hydroxyl ion concentration" stands for alkalinity. If the water contains such substances that the pH is less than 7, the water is acid, and the lower the pH value the more acid it is. If the pH value is above 7, the water is alkaline and the higher the pH the greater the alkalinity. The sum of the pH value and p OH value is always 14.0. If the pH value is 5.5, the p OH value is 8.5. In expressing the acidity or alkalinity of solutions only the pH value is referred to.

It will be noticed that when water dissociates naturally it does not yield

atoms of oxygen and hydrogen but yields hydroxyl (OH^-) and hydrogen (H^+) ions. When water is exposed to the air it takes up oxygen, and most natural waters therefore contain dissolved oxygen. There are limits to the amounts of oxygen which water can absorb. Water is said to be saturated with oxygen when it holds in solution all that it can hold at a given pressure and temperature. The higher the temperature the less oxygen it can hold in solution and the higher the pressure the more it can hold.

Oxygen gas dissolved in water is invisible, but oxygen gas may be present in excess of the saturation point, in which case it may appear in little bubbles of gas. The nitrogen of the air dissolves in water in the same way but not to the same extent. Carbon-dioxide (CO_2) is also dissolved by water, frequently to a greater extent than oxygen.

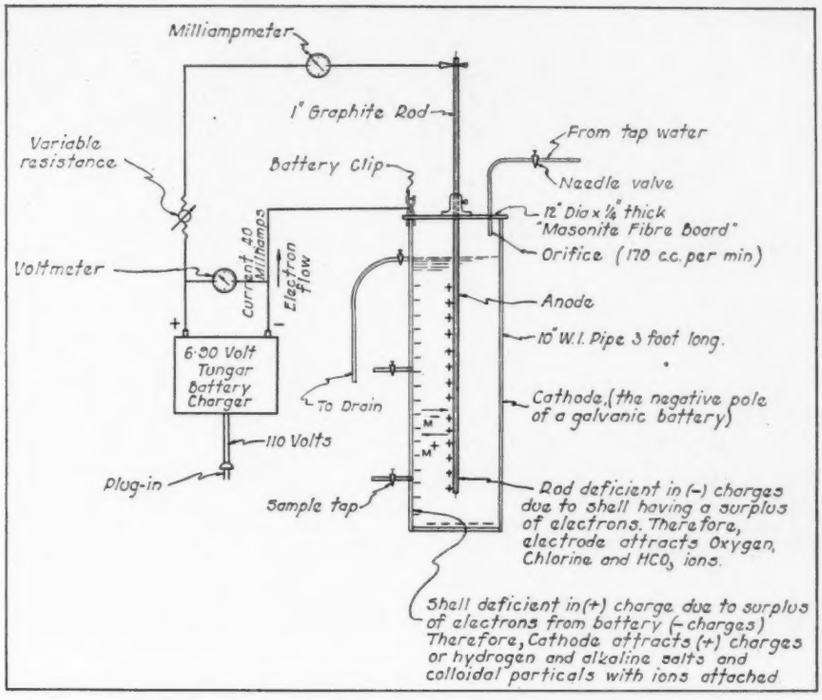
Rusting

Let us now consider the phenomena involved in the rusting of pure iron in contact with pure water. We have already been introduced to the chief actors in the play—water (HOH), the hydrogen ion (H^+), oxygen gas (O_2), and iron (Fe). The hydrogen ion has a pressure which pushes it against the iron, and iron (Fe) has a solution pressure which makes it go into solution. The action takes place as follows:

The aggressive little hydrogen ions (H^+) move rapidly to the exposed metal to ionize it. The positively charged atoms leave the metal surface to enter the solution as double charged iron ions (Fe^{++})

$$Fe + 2H^+ = Fe^{++} + 2H$$

The neutralized hydrogen atoms become "plated out" on the iron that is now in a very active chemical condition. The hydrogen thus plated out would tend to protect the metal from further attacks of H^+ were it not for the fact that the dissolved oxygen (O) steps in, mixes with the two hydrogen atoms forming water (HOH), and thus clears the metal for further attack. In the meantime the iron ion (Fe^{++}) meets with two hydroxyl ions (OH^-) to form ferrous hydrate $Fe(OH)_2$. As the H^+ attacks the iron, more water is dissociated, more H^+ and OH^- are formed, and corrosion proceeds. If the water is not exposed to the air and there is no other source of oxygen, the corrosion will stop when the oxygen has been used up, but the oxygen does something else. It, together with a molecule of water, meets with the ferrous hydrate $Fe(OH)_2$, to form ferric hydrate, $Fe(OH)_3$, a more thoroughly oxidized condition of the iron. The latter is the rust coat of reddish brown. It will be seen, therefore, that in natural corrosion hydrogen ion and dissolved oxygen are co-partners in crime. One might say that the hydrogen ion is the thief and the oxygen is the receiver of stolen goods. It is fair to say that the hydrogen ion causes the corrosion and that the oxygen produces the rusting. Further, rust is nature's protective coating against corrosion—the thicker the rust coat the slower the corrosion.


Milliampmeter
1" Graphite Rod
From tap water
Variable resistance
Battery Clip
Needle valve
12" Dia x ¼" thick "Masonite Fibre Board"
Orifice (170 cc. per min)
Voltmeter
Current 40 Milliamps
Electron Flow
Anode
10" W.I. Pipe 3 foot long.
6-30 Volt Tungar Battery Charger
To Drain
Cathode (the negative pole of a galvanic battery)
110 Volts
Plug-in
Sample tap
Rod deficient in (-) charges due to shell having a surplus of electrons. Therefore, electrode attracts Oxygen, Chlorine and HCO_3 ions.
Shell deficient in (+) charge due to surplus of electrons from battery (- charges) Therefore, Cathode attracts (+) charges or hydrogen and alkaline salts and colloidal particals with ions attached

Sketch of Test Tank and Cathodic Protection Hook-Up
Both stainless steel and graphite anodes were used.

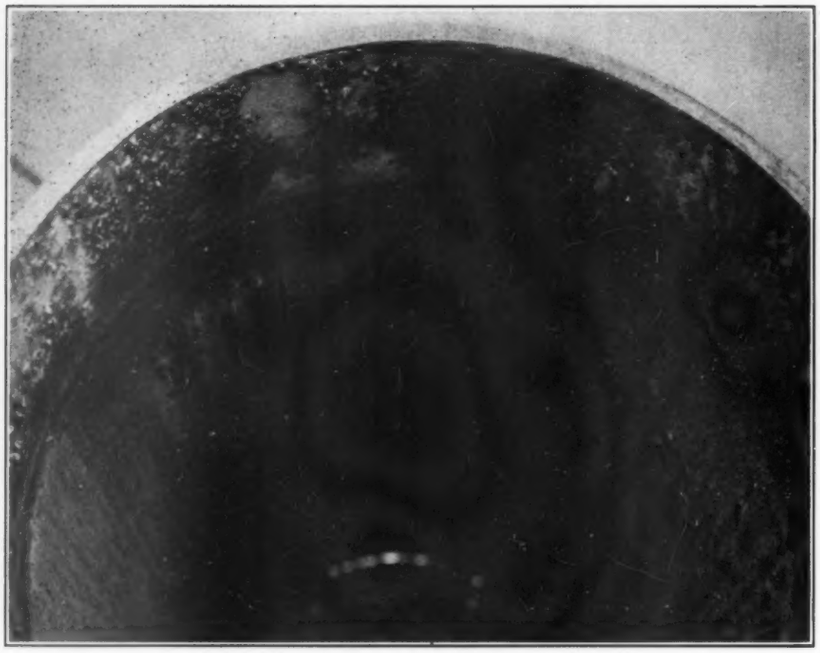
If what has been said is true, then if a method could be devised to collect the oxygen at a non-corrosive pole and plate out the hydrogen at the tank shell, no corrosion of the steel should take place if the gases could be kept there in an inert form. The problem of keeping the gases in an inert form is a hard one.

Plating Out Protective Coatings

As we all know, potable waters contain many substances. The question arose, "Can some of these substances be plated out on the shell in place of the hydrogen to protect the tank?" The answer is that they can, and is the basis of this discussion.

If a negative electromotive force is applied to the tank shell and a positive voltage applied to the carbon or stainless steel electrode in the center of the tank, then the tank steel will be negative in respect to electrode, or we can say the shell is the cathode and the electrode the anode. All chemical substances are masses of electricity, some charged positive and some charged negative in their ionized state. Water is the greatest common ionizing agent we have. Now if the tank shell has a surplus of negative electrons on its surface and the stainless steel electrode has deficiency of electrons on it, the positive ions will be attracted to the negative field while the negative ions will travel to the positive field in an attempt to neutralize the charge, because unlike charges attract. The charge never becomes neutralized because applied electromotive force prevents its doing so.

On our test tank No. 1 a potential of 9.5 volts was applied with a resulting current of 40 milliamperes. After a few weeks a whitish gray deposit began to form on the tank shell and bubbles of oxygen were observed at the 1-inch graphite electrode. The deposit was found to be calcium carbonate. Upon cleaning and polishing a portion of the steel shell surface, the iron appeared to be in a fine state of preservation. The results of the water analysis were very close to those of the tap water supply. Test tank No. 2, where the shell was made the anode, showed great corrosion, while test tank No. 3 showed little corrosion due to the



Protected Test Tank No. 1 After 14 Months

This picture gives the appearance of rust below the high water line. Instead it is a film of soft calcium carbonate paste of considerable thickness. When rubbed off the original metal beneath was found well preserved.

mill scale present. After two months test tank No. 3 began to show streaks of corrosion, while tank No. 1 remained the same. All of these tanks had 172 c.c. of water running into them per minute.

The writer was convinced that the hydrogen ion was not the protective agent in these tests, and to prove the point the running water was stopped in tank No. 1. The surface of the tank shell lost its whitish gray deposit and became clean gray steel, such as is seen when steel is pickled in a sulphuric acid bath. The pH of the tap water was 7.5, while the tank water fell to pH 4.2. The iron in solution changed from 0.02 p.p.m. to 2.40 p.p.m., while the methyl orange alkalinity changed from an average of 40 p.p.m. to 12 p.p.m. of acid. The dissolved oxygen showed supersaturation. The running water was restored to the rate of 172 c.c. per min., which made the condition in the tank the same as it had been before the running water was stopped. The whitish gray film formed again.

Lest we alarm the people that have cathodic protection, it is well to say at this time that the same results would be very difficult to secure in a large water storage tank in service. The current density used on practical installations is much lower than was used in these tests, and the water is of much greater volume. Therefore, the alkoline salts are in greater abundance and there is always some new water added at regular intervals. The object of this experiment was to determine the laws governing this phenomena.

The description of the above test would indicate that the alkaline salts present in waters above pH 7.2 is the protecting agent. It is well known that an alkaline salt solution will protect steel indefinitely. A new steel razor blade placed in a weak solution of sodium hydroxide (lye) will keep bright as long as it is covered with the solution. The Edison cell has nickel and iron plates submerged in an alkaline salt electrolyte. This battery has almost unlimited life if simple care is given it.

Alkaline and Acid Zones Produced

In the test cells the alkaline particles move toward the cathode (—), while the acid particles move toward the anode (+). This should form a zone of higher pH water at the shell and a zone of lower pH water at the electrode. By placing a fine bore glass siphon tube at the shell and one at the electrode, we were able to obtain water samples for analysis to determine the pH. We did not have an electric pH meter available to get the exact results, but by using the standard laboratory indicator and the colorimetric test we found the pH to be 8.4 at the shell and 6.4 around the graphite rod at the center. The tap water at the time of test was 8.0.

In an attempt to find the loss of metal by weight, an iron bolt washer weighing 36.80 grams was attached to the inside of the tank shell for a period of six months. At the end of this period it was taken out and reweighed. It had a deposit of lime over the surface. After it was cleaned and polished it had the appearance of a fine preserved piece of iron and weighed 36.80 grams, showing no loss of weight.

Now, if what has been said about acid and alkaline zones is true, then the reverse should be true for tank No. 2, where the shell is the anode (+). The zone of acid water should corrode the shell. Needless to say, it did and make a splendid job of it.

The iron in the solution in tank No. 2 changed from 0.02 p.p.m. to 50.0 p.p.m., while pH, alkalinity, and dissolved oxygen remained close to tap water. A current of 60 milliamperes at 10.5 volts was used. The sides of the tank show large deposits of slimy red rust, and the water has a very red rusty appearance. The stainless steel electrode has large deposits of lime on it and is in excellent condition. The pH is low at shell (4.5) and high at electrode (9.0).

While we have a simple law to state the action in this cell, the theoretical aspects are not so simple. The writer has listed some fine books on electro-chemistry and allied subjects that can be read with profit by anyone interested further, but he has found none on the cathodic system.

This study started out on the basis of proving or disproving the accepted hydrogen film protection theory. It is well known that the hydrogen film will protect iron if the atomic hydrogen film can be held against the metal to act as a counter electromotive force to bring the galvanic voltage to zero; that is, by complete polarization. If the galvanic voltage is zero, no corrosion will take place. In the cathodic system the desire is to furnish just sufficient voltage to equal the solution pressure of the hydrogen film and thus prevent the iron from going into solution. It is readily seen that this is a difficult job because if the decomposition voltage of the water is not sufficient, the atomic hydrogen film will not form, and if it is too great, the atomic hydrogen changes to molecular hydrogen. The latter has *no* protective powers and is actually corrosive. The over-voltage, or voltage that is necessary to change the hydrogen from ions to atomic and then molecular state, is critical and will change with any change of the elec-

trolyte—in this case the composition of the water. Now, if a voltage is selected that is above the decomposition voltage of the water and is sufficient to attract to the shell small quantities of the alkaline dissolved salts, and if the pH in the water analysis does not fall and iron in the solution does not increase, then we can say that we have a reliable practical system that is not subject to critical factors such as polarization and over-voltage and atomic hydrogen films.

The acid and alkaline zones in these tests did not extend any appreciable distance from the shell or electrode. At a distance of ¼ inch from the shell the pH was normal, but at about 1/64 inch it began to rapidly increase or decrease, as the case may be. The pH at the actual surface of the steel must have been much higher than the tests indicated. Tests from the sampling taps in tank No. 1 gave no clue that these zones existed, as the water from this tank under normal operating conditions gave tap water analysis.

These are the results that were had from the test tanks. In actual large water tanks, alkaline and acid zone may not exist. If the water is of high pH it may not be necessary for sufficient differential in the pH between anode and cathode to drop the anode pH below 7.1, or to put it in the acid zone; likewise, if the water is of low pH, there may not be enough increase in differential to raise the pH at cathode (shell) to bring it up to 7.3. However, regardless of the tap water pH, there will always be a difference in pH between the cathode and anode, except at times of complete polarization. The difference may not bring it into or out of the acid zone. The current density determines the differential. The higher the voltage the greater the difference in pH. The difference must be large enough to attract the alkaline salts and at the same time repel the oxygen ion at the shell. This can be done with a differential pH of from 0.5 to 2.0, depending on the nature of the water. There is no point in using a pH differential greater than is necessary to form a slight alkaline salt deposit.

As stated before, the natural dissociation of water does not form oxygen but decomposes to H^+ and OH^-, but when an electric current is passed through the solution of a value greater than 1.70 volts, plus sufficient voltage to overcome over-voltage and the resistance of the water between the electrode and the shell, the water will dissociate into hydrogen and oxygen. The higher the voltage, the more hydrogen and oxygen produced. If hydrogen is produced in waters below pH 6.5, hydrogen ion corrosion of iron takes place directly without the aid of oxygen. If in waters above pH 7.5 an alkaline salt film is produced, it prevents the hydrogen ion reaching the steel shell. The hydrogen gas is thus formed on the surface of the lime and iron remains inert.

Tank No. 3 Without Protection After 14 Months

The area between the high water line and the tubercles is protected with aluminum paint. The tubercles are hard and dense.

Effect of pH on Electrode Life

At the anode or stainless steel electrode, direct corrosion is taking place. If the pH is below 6.0, the electrodes will have short life. In most municipal waters the pH at the electrode is above 7.0, and if the electrodes are 30 per cent chromium, their life will be indefinite.

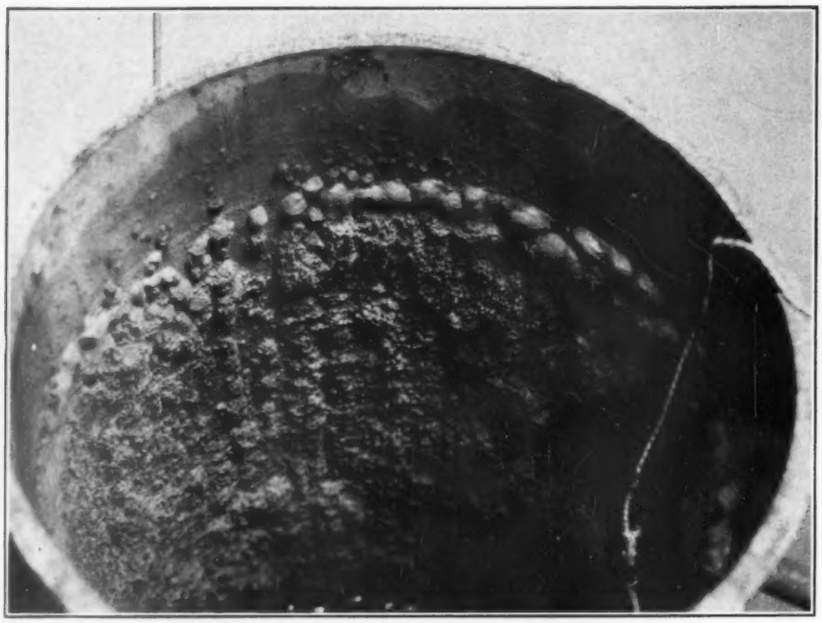
If ideal water could be had where the pH is uniformly 7.1, the oxygen and carbon dioxide removed by deaeration heaters, and hardness controlled such as in boiler house work, then complete polarization could be had. The externally applied electromotive force could be made to just equal the back electromotive force set up by the hydrogen and oxygen films. This is the system used in power plants.

In natural waters ideal conditions are impossible. The temperature, resistance, dissolved salts, pH, dissolved gases, hardness, etc., are ever changing, so that a potential must be used that is above the polarizing value to take care of the worst predicted conditions. If hydrogen and oxygen are being evolved at the electrodes, chemical reactions are taking place at the steel shell and the stainless steel rod.

There is a marked difference between natural corrosion and applied electro-chemical corrosion. Dissolved oxygen plays the leading role in natural corrosion, while the pH value plays the lead in cathodic corrosion. In natural corrosion nascent (atomic) oxygen depolarizes the metal by removing the hydrogen film in water above pH 7.2, thereby causing corrosion. In acid water (below 6.5) the nascent hydrogen attacks the metal directly, oxygen playing the lesser role.

In electrolysis, an external electromotive force is applied and the hydrogen and oxygen are separated and are prevented from acting together as in natural corrosion. In acid water (below pH 6.5) a concentration of hydrogen ions (acid) will attack the metal and severely corrode it with no dissolved oxygen present at the cathode. If this pH is changed to 7.5 and with 100 per cent saturation of oxygen, no corrosion will take place, yet under the same condition it will corrode severely if the electrolysis is permanently stopped.

In the cathodic system, both the hydrogen and oxygen acting independently, can and will cause corrosion in low pH water except when they are completely polarized. This fact is taken advantage of in the cleaning of old tanks. Hydrogen cor-



Test Tank No. 2. Protection in Reverse

This tank had the cathodic protection system connected in reverse, with the stainless steel electrode rod connected as the cathode. The corrosion is due to oxygen, the film on the tank walls being soft and muddy red. On the electrode was a heavy deposit of calcium carbonate. The electrode was not corroded in any way.

rosion forms a smooth, clean, iron gray surface, while oxygen corrosion forms a muddy, red rusty surface.

About Cathodic Application To Old Tanks

It may be well to say a few words about old tanks. Old water tanks can have the benefit of this system as well as new. Most water tanks are painted with a special bakelite base paint or special hot pitch enamel. If the tank is in good condition and no breaks are in the surface, the cathodic system can be applied. However, no results will be seen or had, as the paint or pitch film will prevent the water from reaching the steel. Therefore, no transfer of ions can take place. Now if the paint surface is broken or has pin holes, the cathodic system will come into play by plating out a film of alkaline salts at every break or pin point. Nothing will happen to the good paint surface. If the paint surface is in a bad condition, the alkaline salts will get behind it and perhaps push the paint coating off. If the tank surface is in very bad condition, it will be better to take the tank out of service and remove the rust and coatings by the cathodic system reversed.

The water should be made acid (pH 5), and by alternately reversing the polarity of the shell from cathodic to anodic at frequent intervals, a high concentration of hydrogen (or acid) ions, together with the rusting action of nascent oxygen on the reversed cycle, will break the paint bond. This will cause the paint to slough to the bottom of the tanks where it can be removed. The tank surface can thus be made as clean, or cleaner, than can be had by sand blasting and with much less loss of metal, and very little expense.

If hydrogen ions are present in high concentration, the decomposition of atomic hydrogen is relatively easy, so that the tendency for iron to corrode is increased by increased acidity.

When the cleaning operation is finished and high pH water (7.5) is restored, a film of alkaline salts will take the place of old surfaces. If proper care is given the cathodic apparatus, this should be the end of the corrosion problem.

Some Facts Concerning the Electro-Chemistry of Water

Tremendous units are at work in electro-chemistry. A few will be given here that may be of interest.

The specific resistance of water to a flow of electricity varies greatly, being as low as 25 ohms for very acid water to 25,000,000 for pure distilled water, while copper has a resistance of only 0.000001561 ohm at 0° C.

The number of molecules in one gram of hydrogen (1,000 grams equal 2.2 pounds) is 303,000,000,000,000,000,000,000. A molecule of hydrogen has two electrons for transfer in changing from ions to hydrogen gas, therefore, 606,000,000,000,000,000,000,000,000 electrons attached to hydrogen ions will migrate from the anode to the cathode under the influence of the electrostatic field set up between the electrodes for each gram of hydrogen formed.

The mass of the electron is 0.000,000,000,000,000,000,000,000,000,9 grams. Hydrogen has a mass approximately 2,000 times greater than that of electron, and hydrogen is the lightest weight element. One ampere hour will deposit 26.6 grams of hydrogen, or it will take 12,064 ampere hours to deposit one pound of hydrogen gas.

The electron charge is 0.000,000,000,47 electrostatic units. To bring about the reactions stated above requires an expenditure of energy. Heat energy is so weightless that it requires only approximately 15 grams to convert the average daily consumption of water of the City of Baltimore from water to steam (150,000,000 million gallons daily).

Conclusions

After a test period of 14 months of cathodic protection, test tank No. 1 is in fine condition, the sample water normal, and no apparent loss of metal as determined by chemical analyses and the iron washer test.

Test tank No. 2, that is the one with reversed polarity, is in bad condition and its life may be short. The rust is soft and fluffy and of a deep, uniform layer.

Test tank No. 3, the one with no cathodic protection, has a badly rusted surface but will no doubt have a very long life. The rust is in vertical streaks with beady tubercles, dense and hard. During the first months little corrosion was evident. However, as time went on, rust began to form in vertical streaks. As the streaks formed, more rust became evident and spread rapidly. The iron in solution changed from 0.02 p.p.m. at the beginning of these tests to 1.60 p.p.m. 14 months later. The pH, dissolved oxygen, and alkalinity remained approximately the same as the tap water analysis. It should be remembered that the water entering this tank is the so called "corrected treated water," which, in my opinion, is a myth as long as dissolved oxygen is present in abundance.

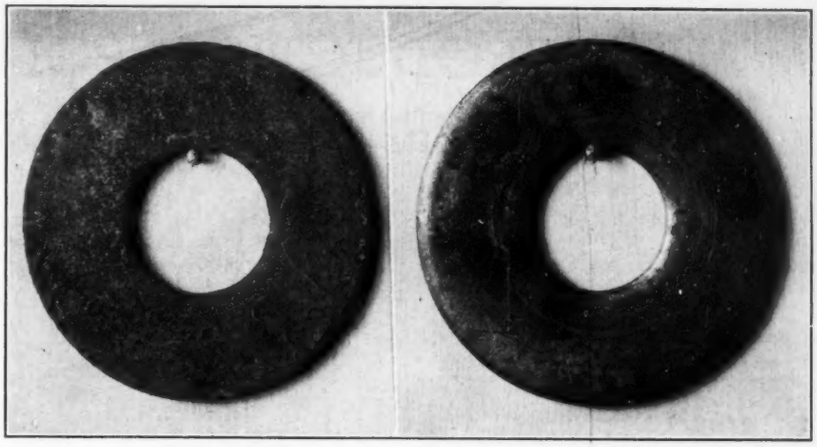
From this study we feel that Cathodic Protection is feasible if

properly designed and installed by reputable manufacturers who know their business.

It appears to be cheaper and more satisfactory than painting.

The upper inside surface of the tank shell should be painted with a special bakelite base paint or by special hot pitch for a distance of 3 feet below the normal high water level to the top of the tank. A little more corrosion can be expected in the area above the high water line than normal, due to the corrosive gases released by decomposition of the water.

Stainless steel electrodes should be 30 per cent chromium of at least 1 inch diameter. The graphite rods on our tests became soft, disintegrated, and lost cross-section, but they gave excellent results insofar as protection was concerned.



Iron Washers Used in Test

The washer at left was placed near the electrode; that at right at the tank wall. The anode washer suffered oxygen pitting; the other was covered with calcium carbonate film. Upon cleaning it showed no pitting and no loss of weight. These washers were in 6 months.

Monthly inspections should be made of cathodic equipment and the condition of the tank. Many things can happen to cause current outage. Proper grounding is important if reversed polarity is to be avoided. The rectifier should also be fused low to prevent too high amperage from accidentally being applied. Lightning arrestors should be placed at the rectifier to prevent fuse blowing during atmospheric storms.

In designing new tanks it may be well to design the Cathodic Protection for the tank rather than use makeshift equipment sold at attractive prices.

For new tanks a thin, continuous perforated monel shell, placed about 12 inches from the tank shell and supported by insulated copper cable supporters from the top of the tank, should give ideal results by distributing field evenly and thereby making a more uniform current density with less current consumption. This shield should have large perforations so as to reduce its weight and expense. It would allow free circulation of the ions. The riser pipe should have a 1-inch monel rod for its full length. The rectifier should consist of several units equipped with an electric clock driven roll time recorder. The function of the recorder is to show the current outage and the amount of amperage applied. The recorder could be made of such capacity as to need changing only once a year. This arrangement would be a costly setup when only first costs are considered. But if the tank can be made to last indefinitely with little maintenance and the cost spread over a fifty year period, the original cost fades into insignificance in comparison with painting and replacing the tank.

The pH of water is of great importance in electrolysis. Any pH above 7.4 may be considered as satisfactory while the dissolved oxygen is of little importance. It should be remembered that every stage of forming atomic oxygen and hydrogen, corrosion is taking place at anode and cathode. The only time corrosion is not taking place is when there is no decomposition. This latter case is complete polarization. If oxygen bubbles appear at the electrode, corrosion is taking place.

Corrosion of the electrodes can be resisted by using inert material or noble metals. If the pH of the water is above 7.4 and the current density is low, hydrogen corrosion can be resisted at the iron shell by an alkaline film. If the pH of the water is below 6.5, hydrogen corrosion takes place because the deposition of alkaline salts is not sufficient, and the oxygen attack on carbon or stainless steel electrodes is severe.

The current used in actual installations varies from 1 to 10 amperes at a potential of from 5 to 30 volts. A 300,000 gallon tank at Baltimore with 3¾ inch stainless steel electrodes uses 1.25 amperes (1,250 milliamperes) at a potential of 15 volts. It should be remembered that the least current density that will give protection is the best current to use. The higher the current density, the more the oxygen will corrode the electrodes.

After sufficient salts have accumulated on the shell, the electrodes can be removed for inspection and replacement if necessary, and this coating will last about 3 months when the tap water is above pH 7.5.

After the film is sufficiently thick, the current can be adjusted to a value that will just hold it there, thereby making the operation costs very economical. As long as a slight deposit remains, complete iron protection is to be had.

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WAR PRODUCTION POLICIES AND WATER WORKS PRACTICES

By J. A. KRUG
Chief of the Power Branch
WAR PRODUCTION BOARD
WASHINGTON, D. C.

What follows constitutes an address by Mr. Krug on June 25th before an overflow session of the A.W.W.A. Conference on Wartime Water Works Problems in Chicago.

The speaker who made a flying trip to Chicago by plane for the purpose became the conference head-liner, the arrangement being so late consummated that his name and topic could not be included in the printed program.

Something of the speaker's background was revealed in Secretary Jordan's introduction of Mr. Krug in the following words:

"The speaker is a product of the State of Wisconsin, formerly associated with the Public Service Commission of that state, then with the Tennessee Valley Authority. For many months by calendar, and many more in expended life and energy, he has been Chief of the Power Branch of the War Production Board; a gentleman of intelligence, of poise and tact and common sense."

Although this address is being distributed widely by the A.W.W.A., we are printing it in full in consideration of its importance, and believing that the message at first hand from so high an authority in the War Production Board to water works authorities and their suppliers of materials and equipment should reach the greatest possible numbers.

J. A. Krug

I THINK it is particularly fitting that the members of your Association are meeting here at this time to see what more you can do in helping to win the war. This is, as you all know, a most crucial period. Everyone knows that Hitler and his allies will make an all-out effort this summer to knock out Russia and Great Britain as a last hope of winning the war. We must, therefore, do everything we can *now* to make sure that the mighty industrial and military strength of America can be brought to the support of our allies, not only in the western hemisphere but in the far away places of Australia, Africa, Asia and Europe. For that reason I think it is most encouraging that nearly 1,500 of your members take time to come here to Chicago to see what you can do in this mighty effort.

It is clear to all of us now that all of the country's manpower, materials, and capital must be devoted to an all-out effort if we are to win the war, and I would like to try to tell you what the War Production Board is doing and how your industry can best help in the work of that Board. In general, the War Production Board is responsible for all-out war production planning. If we had plenty of materials, the job would not have to go further than that. Unfortunately, materials now are desperately short. At the present time the War Production Board is really the custodian of all of the country's material and industrial resources. The Board must make certain that the demands and requirements of our armed forces are all met and that we have a sufficient margin remaining for the requirements of at least our essential civilian economy.

I do not think I have to spend very much of your time talking about the organization of the Board. From your point of view the complexities are not extremely important. The Board's work is set up in a number of divisions and they all have specific responsibilities.

All industry, including the Water Works Industry, is provided for in two main divisions. One of these divisions is responsible for all materials, the other for industry operations. It so happens that the Water Works Industry is provided for in the Materials Division. I guess you should know better than anyone that water is really our basic material.

The Materials Division has a number of branches. Each branch is responsible for a group of industries. The Power Branch, the unit for which I am responsible, has the responsibility for power, gas and water.

The over-all policies of the War Production Board rest in the hands of a group of men in whom the country, and I believe your group, should have complete confidence. Donald Nelson is the Chairman. The Secretaries of War, Navy, and Commerce are also members, and the Board is filled out by the Price Administrator, Mr. Henderson, the Lend-Lease Administrator, Harry Hopkins, General Knudsen and Mr. Lund. Mr. Lund is director of the WPB Labor Production Division.

The Board spends many hours a day on the over-all policies of war production. I think Mr. Nelson is doing a really amazing job in getting the great web of American industry reorganized to do a war job. Specialization developed through years in peacetime pursuits is not very easy to change overnight.

For all practical purposes the water industry needs to concern itself only with the Power Branch of the War Production Board. Under the Board's organizational plan not only is the planning function incorporated in the Power Branch, but included as well are the priorities and supply allocations functions.

We have a comparatively simple set-up. Omitting the units of the Power Branch which have no direct bearing on your problems, we have three main sections. One is production, the second, priorities, and the third, supply allocation.

The job of the production unit is to assure an adequate supply of power, gas and water for the war effort and for all of the essential civilian

needs. By essential civilian needs I mean just that. This country has become accustomed over a period of years to a most extravagant scale of living, and this scale of living pertains not only to the so-called luxuries but also to the essentials such as water, gas and power.

The priorities group section of the Power Branch has the responsibility for seeing to it that industry gets the material and equipment needed to assure adequate service. At the same time we must make certain that the materials allocated to the utility industries are used wisely; that the systems which need material, get it; and that those that are wasting it are sought out and the practice stopped.

The allocation section has the unpleasant job of dividing up the supply when there is not enough to go around. Water, like death and taxes, has been taken so much for granted that it is hard for us to realize that the time might well come when in some areas the supply of water is not sufficient to meet all requirements. The War Production Board has adequate authority to permit you to cut out those uses of water which are not important in the war and to conserve your water supply for those which are essential.

We could spend a good deal of time talking about the problems that each of these sections encounters, but I will not take up your time to discuss the details. I think you should know that in recent weeks Mr. Wolman, who is your new President, and I might add, one of the most capable engineers in the country, has been assisting the Power Branch in organizing a country-wide survey of the critical water use areas. By this survey we expect to develop an intelligent basic plan for taking care of the country's water supply requirements for the duration of the war.

We are organizing to assist in the survey work of a small group of engineers who will be available to help you on your supply problems. Your supply problems, which in normal times are just your affair, in war time become the country's affair. Not only must you supply water in adequate quantities for the war effort, but the plan you adopt must be the one that uses the minimum of critical materials.

Factors of Consequence

I would like to try to outline the various factors which I think the Water Works Industry should be taking into account in gearing itself to the country's job of winning the war:

Adequate Water Supply

The first I have already mentioned. It is your responsibility to see to it that an adequate water supply is available for all essential requirements. It is a responsibility of no small proportions. You must also see to it that a supply in excess of requirements is not provided where new construction is involved and critical materials are at stake.

Reduction and Substitution for Critical Materials

You must concentrate on the job of reduction and substitution for critical materials. We have operating now in the power field and in the gas utility field representatives of the industry who are seeking ways and means to economize in the use of materials. It is a responsibility of the Water Works Industry to carry out that same function. I know from what Mr. Jordan has told me that you have devoted a great deal of thought to it. I think I should say frankly that the country is desperately short of those materials that are basic in the water industry. Every pound of steel and copper that you use today in your water systems comes directly out of the military program. We could use all of it for military purposes if it could be spared without disrupting essential service.

I do not think that the materials situation is going to improve in this year or in 1943. The bottlenecks in steel and copper production cannot be rectified even if materials were available for new production facilities in so short a time. As an example, one steel expansion recently projected, later rejected, required 500,000 tons of steel for plant facilities to obtain an annual output of 1,000,000 tons. You can imagine that, with our great need for tanks and ships, much material cannot be devoted to providing new materials, and certainly not if those new materials are going to be used in purely civilian pursuits.

I hope you all will keep in mind that everyone in the War Production Board recognizes that water is an essential public service. There is no question there. The only question is how can water service be assured for the duration of the war with the minimum use of critical materials and therefore in the best interest of the all-out war effort.

Revision of Design and Construction Standards

I think the desperate materials situation really warrants a complete revaluation of all of your standards of design and construction. The water utilities have a right to be proud of a long history of plant improvement. You have reached a point where water systems are permanent, efficient, and economical. You have made it your business to see to it that the system you lay out and install will last as long as possible and will require the minimum of upkeep. That kind of engineering is, of course, basic common sense in normal times. Unfortunately, these are not normal times and we are in a period now where you may have to change your sights. It is no longer a question of economy in cost or economy in operating expenditures. The basic question is one of economy in materials. For the duration of the war you must design your facilities with the point of view of restricting the use of steel, cast iron, and copper to a minimum. That might even require going so far as using wooden staves for pipe lines where you can. It certainly means eliminating all new lines where reduction in nonessential uses will take care of your requirements.

I do not pretend to be a water expert. Regardless of the competence of people on our staff we could not do the job of determining for you how you can contribute the maximum to the war by finding ways of using less critical materials. But I have enough confidence in the ingenuity of the American engineers to know that if you are given that job and if you know the importance of doing it, you will do a perfect job of it, just as you have done on the long-range job of providing water service to the people of America in the most economical manner.

Unfortunately, the sacrifice for the Water Works Industry is probably of greater proportions than for most other industries. Your plant is long-lived. Once you have it in the ground, it is there for a long time. If you install plant facilities with high operating and maintenance costs, you have to bear those costs for a long period of years. Regardless of that, the material demands of the war, particularly during this year and next, are so great that I think the people of America will be more than glad to accept even for years after the war, any additional

burden in operating cost that might come from the planning you do today to make your operations fit in with the best interest of the country.

Revision of Maintenance and Repair Standards

I think the materials situation also calls for a revision of your maintenance and repair standards. I think we should revise the old slogan. It should now become, "Do not today what you can put off until tomorrow." It would be amazing to look over the repair jobs for industry generally (and I am not speaking now particularly about the water utilities) to see the number of jobs that could be deferred if we are willing to take the risk and chance involved. Materials today are worth four and five and ten times as much as two years from now and this justifies your taking whatever chances are involved. I know that you will scale your maintenance and repair standards to the very bone.

Elimination of Non-essential Uses

I have talked on a number of occasions with representatives of the water utilities about the prospect of restricting non-essential uses in order to avoid expenditure of materials. Those who are really interested in the serious problem of materials supply during these days tell me some very interesting stories about how much new plant expansion could be avoided if you were to scale down unnecessary uses of water, and do a complete job of stopping leaks and unnecessary wastage. That is one of your industry's most important problems today. But it is certainly not the kind of thing that can be done easily from Washington. The problems vary greatly from one system to another, but you gentlemen who have had long experience in operating water works know how it can be done. It is the sort of thing you can and should do on your own, the kind of contribution you can make to the war effort without any yeses and noes from Washington.

Extensions to War Housing Projects

Of course, it goes without saying where new facilities are needed, they must be provided. Where they are needed I am sure that all of you will bend every effort to make certain that the plans involve the minimum use of critical materials. As a matter of fact, in some of these tremendous war housing projects it may be necessary to install central sanitation and bathing facilities in order to avoid the outlay of mains and services required to extend service over these wide tracts of housing projects.

We have been working intensively now for weeks with the Housing Authorities in Washington and have perfected a scheme of utility standards for war housing projects. Those standards will apply to water, gas and power. The plan requires that the necessary utility arrangements be cleared before approval is given for construction of housing projects. There will be no more high-powered schemes for scattering houses over 200 or 300 acres of land and realization six months later that there are no utilities services in the area to take care of the defense workers.

I hope that you will all study this new plan very carefully and that you will work with your local housing people on the problem of coordinating your plans for water service with their plans for defense housing.

Stock-taking of Water Requirements

I think this is the time for stock-taking on the part of each individual water system as to its requirements for water and its plans for meeting those requirements. Over a period of years the public generally has just assumed water would also be available in the amounts needed. Most of you have followed very foresighted planning and in most parts of the country water supply is assured for years in advance of current needs. I think you should make a careful accounting of your water requirements during the next two or three years. With the shortage of materials, projects that could be carried out in six or eight months in normal times now require four or five times that long.

Once you feel that your area is going to be short of water, we will have staff available to help you develop a plan of supply for which materials can be provided. Of course, in areas where shortages threaten, the first job is to reduce the demands for water to a level where they can be met by the existing supply. You will be amazed at the ingenious ideas that have been offered to that end. I think you will find that in many parts of the country, perhaps on the systems that many of you represent, a really effective job of avoiding waste and restricting non-essential uses will eliminate any need for new facilities. That, of course, points up the real problem. When we have to adjust the supply so closely to requirements, the danger of not having enough for essential uses is greatly aggravated. It is a risk we must take.

Water Use of War Industries

Now there is another job which the industry itself can do better locally than anyone in Washington. Around the country there are literally hundreds of war industries springing up overnight. They each have a primary job: that is to produce war materials. The managers of these plants are not much worried about how much power or how much gas, or how much water is used. They are concerned primarily with how much war material they can turn out, and that should be their duty. It should be your job to study their use of water and help them to use it effectively. For example, in the case of airplane engine plants, we have found that by a minimum coordination of the operation of their engine test cells they can in most cases generate as much electric power as they need. Similar economies must be possible in the uses of water. I think it is the responsibility of each water system operator serving vital war industries to make sure that the utilization of water is as efficient and economical as it can be made.

Operation Under Order P-46

Now I am sure that what most of you would like to hear about is Order P-46, and how you have been operating under it.

We have had almost nine months of operation under P-46. I am sure that a fair appraisal of this preference order as against other similar orders will lead you to the conclusion that it is as favorable as any granted to industry. Of course, you will encounter difficulties from time to time with any blanket preference order. At the present time the ratings providing for many classes of maintenance and repair are not sufficient to procure the material you need from the supplier. We know that. It will not help any to change the ratings every two minutes up or down. You cannot make Chinese money out of the preference system. You cannot make materials just by assigning preference numbers. You have got to find a plan to scale down the use of materials to fit the supply. When you have reached that point, the preference ratings will work.

There have been a number of complaints from the utilities about the difficulty in obtaining supplies, particularly for emergency repairs when

something is out of service and you have to get it back in again promptly. We have been giving that a great deal of thought. Before we discuss that problem in detail, I would like to summarize some of the figures we now have on the operations of the water industry under P-46.

We have reports from only about 40 per cent of the country's water utilities. We have kept it at that percentage because all we need is a guide and we have tried to avoid burdening the smaller systems with the elaborate report forms that are necessary to get an accurate measure of the materials which are going into water works maintenance and repair. I think the reports we have, representing over 200 of the large ones, are a fair indication of what is going on in the industry.

I am sorry that, at this time, it is not possible to say that water utilities have done a good job restricting their use of materials under order P-46. I think you will agree with me when you hear the figures.

For the first quarter of 1942, you used about 95 per cent of the dollar amount of materials used during the corresponding quarter of 1940. The actual dollar figure was $3,450,000, excluding fuel, as against $3,623,000 for the first quarter of 1940.

I would say if it were only the question of use of materials alone, we would not have any reason to be discouraged. In the matter of purchase of materials, however, the record is not as favorable, for, in the purchase of materials, the water utilities reporting exceeded the requirements of P-46. P-46 restricts quarterly deliveries of materials to 25 per cent of the material used in 1940. The actual amount was 28.8 per cent for the first quarter of 1942. Preference rating P-46 provides that materials cannot be accepted for delivery if the inventory is above the practical working minimum. Had these excessive deliveries been accepted when inventories were low, there would be some excuse for it. However, it appears that inventories are not low. During the first quarter of 1942 deliveries accepted increased the inventory on hand and at the present time the water utilities reporting have an inventory of $16,500,000 in round numbers, as against $14,900,000 at the end of 1940.

Looking over some of the so-called critical items, the items that have caused you most difficulty, we find that the companies reporting have on hand for most critical items about two years' supply. Now granted that in normal times a two years' supply is a comfortable working margin, some way will have to be found during this period of war emergency for the water utilities to live off this accumulated layer of fat.

For example, there was an inventory of cast-iron pipe at the end of the first quarter of 1942 of about $4,250,000. The use in that same quarter was about $500,000, indicating for that item better than a two years' supply.

For steel and wrought-iron pipe, the inventory was $450,000. The actual use was $50,000, indicating better than a two years' supply.

Copper and brass pipe and tubing, one of the most vital of war materials, show an inventory of $402,000 and actual use of about $68,000.

Lead pipe inventory was $96,000 and actual use $19,000. Pipe fittings —these cause trouble for many of you—show an inventory of $2,800,000 and an actual use of only $176,000.

I am not going to take your time to go over this entire list, but I think the items I have mentioned should indicate the prospect of using at least for a while these accumulated inventories.

We have obtained permission from the WPB Priorities Division to permit one water utility to place with another water utility orders under P-46, which can be filled out of the surplus inventory. That means that regardless of restrictions on the use of copper and other materials, if another water utility has material which you need and which you have a right to obtain under P-46, you can get it by placing an order against that utility for the specified material. We have not made the acceptance of those orders mandatory because we are not staffed to police bare minimum inventories. But if it is impossible for the industry to work out this arrangement on a voluntary basis, some plan of pooling all inventories will have to be developed, and I certainly hope we can avoid that. This is the kind of job that your Association can do most effectively.

As a further help in the direction of making order P-46 truly effective, an amendment has just been adopted which should help you materially. (See P-46 as amended in the July Journal of A. W. W. A.) In the first place, under this amendment, utilities after July 1, 1942, will be able to apply a rating of A-1-c to deliveries of material required for repair of an actual breakdown of existing facilities, or to make reasonably advanced provisions for such repair—providing that such A-1-c rating shall not be applied to more than 30 per cent of the material within any class which could be scheduled for delivery under the provisions of Section f of P-46. We hope that this provision will take care of the items which you are unable to obtain by placing the regular ratings against suppliers or other utilities having comfortable inventories.

Part of this order you may not like, although I must say I cannot see why you should not. After July 1 you will not be permitted, under the terms of order P-46, to run extensions to anyone, regardless of what the cost is except where the premises have been piped ready to receive service before July 1 or the foundation under the main part of the structure has been completed before July 1. That means there will be no new extensions of water service except under those two conditions, the only exceptions being housing projects and war industries that will be cleared in the manner I described before. The reason for that provision is that there is now no excuse for building except as provided under the war housing arrangements. Anything that is built otherwise will have to go without water supply until after the war. Individual hardship is always great in time of war and it is particularly great when it comes to utility services. We know how vital water supply is to the general public but extensions for civilian purposes cannot be made at a time when the country needs all of the steel and all of the copper to carry on the war.

I know that many of you have questions as to the interpretation of P-46 and what you can do under it and why it isn't one way rather than another. I would like to say that we have a staff organized to answer any inquiry you have under P-46 or to talk with you if you feel your question requires verbal explanation.

The order is complicated. Unfortunately, we found no simple way of doing it. If any of you has a simple way, I wish you would let me know; because complexities of life being what they are in Washington nowadays, I can't tell you how much I would appreciate it. We think it is a practical and effective way for your industry to get the material it must have, and at the same time put the "brakes" on those utilities that would still like to think in terms of business as usual and engineering as usual, in order not to use up mate-

rials essential in your program and in the war effort generally.

I cannot tell you how much time and thought the question of allocation of materials has been given in Washington. It has occupied the time and attention of some of the country's best talent but the tremendous job of finding some simple and practical way to divide up materials among the thousands of American industries in a way that will do the war effort the greatest good is not a thing that can be reduced to a formula.

I am hopeful the plans now under way will scale all programs down to a point where there is sufficient material for everything that must be done. All I ask is that you have confidence that a plan will be devised that will permit you to get the material that you must have and that it is your part of the job to be sure that you are trying to get only those materials that you absolutely need.

In closing, I would like to ask this —that everyone of you gentlemen go back home, call together your operating staff, let them know how serious the material situation is and go over with them a plan for cutting down the use of materials in your own operation to a minimum. I think that the purpose of this meeting will have been served if all of you make a re-appraisal of the material needs that you are now exerting and cancel those that you feel you can get along without. It is hard for a man responsible for one important phase of our industrial economy to gear his problem into the national problem, but all I can do is to tell you sincerely that the demand for materials is so great that any step you take to reduce your demands for material, regardless of what that means in terms of our normal living, will be justified by the increased production of war materials that will be so vitally needed during the balance of this year and 1943.

I have a number of things that I probably should talk about today, but I guess I have had my turn. You should have yours if there are any questions you would like to ask me.

I wish to thank you for listening so attentively.

Secretary Jordan: I am sure that Mr. Krug recognizes the fact that the attention which he has received indicates the intense interest of the people who are in this room, their desire to understand and their wish to cooperate. I am satisfied that of those of you who entered this room three-quarters of an hour ago, having in your mind certain questions concerning the entire materials situation as it affects the water supply industry, many of you now have a far better understanding than you had before. You will not need to ask some of the questions that you had in mind when you came.

I am sure that every one of us appreciates the honor that has been conferred upon our incoming president by assigning him the task of appraising the needs of cities over the country for additional water supplies. We know his capacity and we are sure that this Association through him will be able to render service in this particular category. We appreciate the opportunity that it has for service.

I hope that no one of you overlooks the broad significance of Mr. Krug's very brief sentence—that no longer would it be possible for men to go out and promote a real estate or so-called housing development without any attention being given to the utility needs until the building neared completion. That, of course, stated briefly for you what has been brought to your attention before this week, that under the terms of the new housing standards, the housing project itself and the utility services associated with it are to be considered at the same time and to be rated at the same time. Failures to integrate in that regard we can properly assume are past.

There are one or two questions that have been handed to me prior to the meeting that I might present to Mr. Krug at this moment in order to get things started. It would be useful if he would explain to the people here the diversity of organization within the War Production Board which, purely as a by-product of human nature, makes it impossible for every order that issues from every division to be absolutely integrated with every other one. Perhaps many of us occasionally do not appreciate the spread and size of the organization.

Mr. Krug: If I try to carry that out literally I think I would be here the rest of the day. But to give you a thumb-nail sketch of the problem as I see it, we have on the one hand the Army and the Navy. They need certain material and equipment and their needs must come first. We have on the other extreme our civilian economy, and certain of its needs must be met. In the hope of resolving all of those needs with reasonable harmony, the War Production Board was established. Within the War Production Board there is a division responsible for industry operations; another is responsible for the production of materials; and a third group is responsible for the allocation of materials to the various classes of industry.

Now let us take a problem outside of my own field so that my view will be unbiased.

The copper branch of the War Production Board is responsible for making certain that there is an adequate copper supply for all of the purposes of the Army and Navy as well as for the essential civilian requirements. Let us assume that we have reached a point where the supply of copper is insufficient to meet all requirements. The copper branch could reduce requirements to available supply by conferring carefully with each of the thousands of industries involved, making certain that in advance a plan is developed which will do the job most effectively. We would have the copper problem settled but probably not until after the war.

As an alternative, those in the copper branch can take the information available on the use of copper, not only in amounts but in type; they can apply their best judgment and come out with a plan of action that will probably have some mistakes in it but it will effectively cut down the use to the available supply. The errors and the conflicts can be worked out as they appear. That, in short, is the only procedure which the War Production Board has found possible to carry out.

As a concrete example, we had the job last fall of trying to scale down power use in the south to meet the available power supply. If we had tried to do that job through consultation with every single industry and individual affected, it is safe to say that many power reservoirs in the South would have been drained and war industry demoralized before action could be taken. We had to proceed with the information we had and hope to rectify speedily the errors thereby incurred.

You are in effect an end-user of many materials. A number of these different orders affect you and you see inconsistencies between some of them. Your job, once you see an inconsistency, is to bring it to the attention of the Power Branch and we will move with as much expedition as possible to correct it.

I have noted a number of the inconsistencies that are pointed out as being extreme. I think, carefully analyzed, they are not extreme; they are not even important. The important thing is to make certain that

war plants are kept operating at capacity and that civilian discomfort and hardship are not unnecessarily severe.

I think that you will find very few WPB orders that are inconsistent with respect to the Army and Navy program or those parts of the civilian program which would cause a demoralizing effect on the war efforts. The American people, appreciative of the problems encountered, will be patient and sympathetic with minor administrative mistakes that are unavoidable in any program so comprehensive.

I think Mr. Nelson would be the first to admit that his organization is far from perfect. I doubt whether he would claim that it is as perfect as human ingenuity can contrive; but he certainly would insist that it is the best organization that he could create, giving all of his energy to it. I think that goes for most of the other people in Washington who have a part in the war job—the Army and Navy and the War Production Board, as well as the other war agencies.

If we make mistakes, if your industry is seriously affected by some ruling, you have a place to remedy it in Washington, and that is where you should go.

It is important in this connection that the water industry assume its fair share of the responsibility of explaining the terrific proportions of this task to the public. I have in mind, for example, explaining to the public in your service area why it is necessary to impose restrictions on the extension of service. You know perhaps better than anyone how much material it takes to supply water service. You have been told, and I am sure you have every reason to believe, that every pound of material is needed in the war. I think it is your job to explain to a prospective customer why he cannot have service rather than to say, "We have plenty of material, we have plenty of water, but some bureaucrat in Washington is saying, 'No, you can't have water!' "

It is not a question of whether or not you have material. If you have material that could be used for nonessential extensions, it ought to be made available to some other utility that needs it to serve a war industry.

I do not feel that I have answered all the questions about the conflicts in orders. I have simply tried to outline for you the pattern that creates those conflicts and the reason why I think it is better to get some action with a few mistakes than try to get perfection and not have any action at all.

Secretary Jordan: One more question before the questions are thrown open. The members of this Association have been advised concerning Allocation Classification System and the series "end use" code numbers. They appear to have a little apprehension concerning the fact that water works are down in section 12. Can you assure them, Mr. Krug, that the number "12" has no adverse significance insofar as ultimate standing is concerned?

Mr. Krug: The answer to that is very simple. It does not have any whatever.

Secretary Jordan: From this moment will any one of you who has a question to offer come up to the microphone and address your question in such a fashion that those in the audience can hear what you are asking and Mr. Krug will have an opportunity to answer.

Mr. W. W. Brush (New York): Mr. Krug, this is a basic question. Could the industry obtain assistance from the federal officials in plans for making an appeal both over the radio and through the press for each and every consumer to reduce his or her individual demand? This I believe would result in almost immediate reduction in the demand for water and a resultant reduction in the materials required in the industry.

Mr. Krug: Yes, indeed. The War Production Board is available at any time to work with the industry on conservation problems. There is a staff available for that general purpose, and in the Power Branch we have a group working with industry in developing a program of advertising and public relations work. This, we hope, will bring home to the people of America the contribution they can make in limiting their use of essential utility services to a minimum. If your Association is interested in working with us on that kind of a program, we would be delighted to meet you more than half way.

Mr. Lloyd Nelson (Philadelphia): I have two questions, or one in two parts. If the answer to the first is not what I think it is, there is no use making the second part. Under Order P-46, are these inventory reports you get intended to include only the material that was on hand and was secured on P-46 priority ratings or should material secured on specific priorities that had been assigned for specific war jobs also be included?

Mr. Krug: The inventory account is to include only the inventory that is applicable under P-46. Materials required for a special project on which you have a project priority rating are not to be recorded in that inventory.

Mr. Nelson: That was my understanding. I am afraid there is some misunderstanding as to that in these reports you are getting because from the supply angle I am quite sure there has been no such increase as you mentioned in inventory secured on P-46. Some of those materials have not been available for delivery during the first quarter and I am afraid some of the utilities have included temporary supplies of materials they have secured on other priorities. Such material may be held waiting delivery of materials that take a longer time to get or waiting repair parts requiring a higher priority rating in order to get delivery before the work can be completed.

Mr. Krug: I think that explains part of it. However, the reports show material delivered exceeded material used under P-46, which in one quarter alone accounts for about one-half of the increase in inventories over the end of 1940.

Mr. Nelson: The second question I had in mind was: What is the proper procedure for a user of materials for water supply purposes to follow when, during the base period under P-46, the user made no purchases for maintenance because of some municipal budget difficulties or some other reason? What can they do now in order to secure parts that are actually needed for prevention of breakdowns or repair of equipment that is actually out of service and which they cannot secure under P-46 at present.

Mr. Krug: If the base quota is unfair because it is abnormally low, the procedure is to write to the War Production Board, Power Branch, stating the facts and asking for permission to accept deliveries in the quantity needed for that particular class of material or equipment.

Mr. Wm. Wallace (Detroit): We have often addressed requests to the Power Branch, attention of you, Mr. Krug, and received a reply from some other branch, such as Mr. Maverick, or somebody else. We wondered if that can be cleared up, because we feel that the Power Branch has a clearer appreciation of our difficulties?

Mr. Krug: I am glad to hear you say that. I certainly agree with you that it should be cleared up and an effort has been made to clear it up. Unfortunately, when there are thou-

sands of people working on the war program, it is hard to supervise the letters that any one of the group might write. The problem with Mr. Maverick's section is something like this—he is generally responsible for governmental requirements and we are responsible for all water, gas and power, whether or not publicly owned. We have an agreement under which Mr. Maverick's section gets an opportunity to review our decisions on publicly owned utilities. His people are not supposed to contact the industry directly and I think sooner or later that will be cleared up. I am sure it has caused confusion and I have been as disturbed about it as you have.

Mr. Wallace: Another question along the same line. On mere routine priority requests, why could they not be handled by a local WPB branch?

Mr. Krug: Well, under the new housing order that will be true on housing. The primary obstacle is to find where to draw the line and I think that with the regional set-up of the War Production Board, more and more will be done in that direction. Of course, the main concern is to be sure that some one man is responsible for allocating materials. To establish standards that the field offices can use for making material available has not been easy, particularly not easy in the utility field. I do hope that very small items, if not handled locally, can be speeded up some in Washington so it will not require weeks of delay in getting action.

Mr. Wallace: Now the third question I have is in the relation to plant protection. In Detroit, we have been assured by the FBI, by the Military Intelligence, and even by the President himself, that we may expect bombings. In order in some measure to take care of protection for our utilities, not wishing to spend any more money than is necessary but still to do what is right, we have made application for certain equipment and the like. We take the application to the WPB and their civilian employees say there is no danger, that we don't need these things. What are we supposed to do?

Mr. Krug: I am afraid you are out of luck if that is what they tell you. There are many agencies which pass on the desirability of a certain use of material, and all these uses are desirable, many of them are essential, but if there isn't enough to go around, you have to scale down until you get to a point where the available supply takes care of all of the requirements. If that cuts out certain serious needs, that is too bad, but they have to be cut off.

I think all of us would agree it would be stupid to use up steel in protection against a theoretical bombing of Detroit if that same steel is needed this year to produce shells or tanks or something of that kind.

I do not pretend to have the higher judgment as to where to draw the line. But I am sure that the various branches responsible for materials have cleared at least with the key people in the military effort to be sure that, if they are telling you no, that view is supported by the War Production Board, which includes representation from the Army and Navy.

Mr. T. H. Wiggin (New York): My question is in regard to decentralization on emergency repairs. We have occasionally a broken coupling or bearing and so forth, and that request goes to Washington and takes some time. Must this be so?

Mr. Krug: Yes, particularly in regard to emergency repairs. I can assure you that emergency repairs can be handled effectively only from Washington. The problem of supervision is a tremendous one. The job is that of being sure that the real emergency is taken care of and the others are culled out. Now if you have a real emergency, get on the telephone and talk to someone in the Power Branch and I can assure you you will get prompt action.

Mr. Wiggin: We have been doing that.

Mr. Krug: If you have specific cases where you are delayed more than two days I wish you would call me personally. You realize that if we are to make the arrangements for emergency repairs really effective, we have to be sure that no one is sliding through ordinary repairs under the guise of emergency. That is becoming more difficult all the time. It is unfortunate, but out of thousands in a given industry there are always a few who will try to run something through, and if those few succeed, it would demoralize the whole procedure.

This means, first, that it is important for you to ask for emergency relief in only emergencies, and second, that when you do ask this, you make your case so clear that the job of checking and verifying is comparatively simple. If somebody, for example, sends me a ten-word telegram: "Give me immediate approval to do this or that," by the time we get verification of exactly what he wants several days have slipped by.

I think if any of you encounter delays on emergency repairs you ought to write to me, stating the circumstances so we can be sure that procedure is speeded up.

Mr. Wiggin: I have one more question, namely, with respect to the time required to act upon projects. My experience has been that this takes about seven weeks and by that time the quotations that we had have gone out. They are no longer available and we have to start over again. I am talking about projects which are not desired particularly by the owner, but they are requested because they are essential for war plants which are waiting for water. Yet it does take a little while. I am wondering if it wouldn't be better to guess wrong, turn it down if necessary, rather than to leave it dangling for so long.

Mr. Krug: Everything possible is being done to speed that up. The records show the average time of clearance of a project is not 7 weeks; it is closer to 2 weeks. There are some, of course, in this group that have gone months, and others that are cleared in a few days. Under the directive controlling the operations of the Power Branch, it is our responsibility to make certain that the project is essential in the war effort and that it involves a minimum use of critical materials. Carried out literally that would mean we would have to engineer your water systems for you. We can't hope to do that. All we are trying to do is, in the questionable projects, to be sure there is enough review and investigation so that the record is clear that our functions were carried out effectively.

Mr. Wiggin: May I just make a stipulation on my remarks? The delay in none of these cases has been in the Power Branch. There it was handled promptly but thereafter it seemed to get into the hands of an endless number of committees which finally produced, but after the time when the quotations had expired. The negotiations had to be started over again.

Mr. Krug: That is a difficulty and I am afraid we are just going to have to live with it. For example, almost every water works project involves a substantial quantity of steel. The steel people have a problem of their own and they have to make sure that, in a given period of time, they are not allocating more materials in priorities than they have. During the past four or five months about half of the steel-consuming projects, even where desirable and

so considered by other branches, have had to be culled out, and incidentally some worth-while projects get held up in that delay.

The new program of scaling down all activity to a point where materials will be adequate should automatically settle some of this difficulty. Mr. Nelson has had organizational experts working on it diligently now for several weeks. I hope they will find a solution. When you consider that almost any project that comes to the War Production Board involves not only several branches but also the Army and Navy, to submit it one day and clear it the next is not very simple. In the utility field the number of projects is tremendous. At the present time there are from 500 to 1,500 P-D1-A applications handled every day in the Power Branch. The number of project applications is 30 to 150 a day. So if there is a carry-over on some of the projects that runs for several weeks, you can understand how such delays are inherent in the job of trying to make an appraisal of the large number of projects proposed by American industry and decide on those that should go ahead and those that should stop.

Mr. L. H. Enslow (New York): Mr. Krug, I know that there are a great many in this room, and there will be a great many all over the country, who are going to be materially relieved to find that they have an A-1-c rating coming through for true emergency repair work. The 30 per cent limitation I think could be clarified a little bit, if you will. I am sure, I couldn't quite understand it myself and it is important.

Mr. Krug: You understand that now under P-46 you can apply the rating specified there for 100 per cent of the deliveries you received in the so-called base period of 1940, with certain adjustments. This 30 per cent figure relates to that base period. While the general ratings A-5, and A-2 apply to 100 per cent of those items, to 30 per cent of the same amount in dollars you can apply the A-1-c rating. So if you had, under P-46, as it stands now, the right to take during a certain quarter $10,000 worth of a certain group of materials you can apply the A-1-c rating under these specified conditions to $3,000 worth of that group of material.

Mr. Enslow: Mr. Krug, the situation in this field is something like this: Men who operate these plants have contracts with the houses that supply materials and machinery. These supplier representatives know pretty well the situations that actually exist in the various plants. They are not merely sales people, but are on the whole sales engineers.

I would like to know this, and I imagine others would, too. If an operator really gets into trouble and he is not successful in getting to you or Mr. Crinshaw or somebody else in Washington, would you permit him to work through his supplier whom he knows has to supply that material or piece of equipment?

Mr. Krug: You mean would we permit him to work through that supplier without any priority control whatever?

Mr. Enslow: Would you permit the supplier to do the actual physical job of getting in touch with your people in Washington, explaining the situation in detail and then being allowed to supply the material or piece of equipment immediately?

Mr. Krug: If the supplier is by official recognition a representative of the utility, he could negotiate in Washington just the same as an officer of the utility, but we cannot have any relationship that is haphazard. If a supplier were to call us and say "Here is a desperate situation. I am talking for the XYZ Water Company and they have to have this," and we acted upon his representation and later on there proved to be an error in the representation, the water utility would say he acted without authority. If you have authority to act for the water utility, you can act for them in any capacity. If you don't have such authority, we could not accept the responsibility of the supplier as a responsible agent for the utility.

Mr. Thos. Skinker (St. Louis): Mr. Krug, where a utility has a surplus of materials which are not indicated on the inventory, what can they do to assist you and the War Production Board?

Mr. Krug: The way you can assist us most (and I think perhaps we will have to work with your group to formulate the outlines of this plan) is to let other utilities requiring materials know about your surplus materials so that they can order the materials they need against you under P-46. Perhaps some of you know that in the case of the electric utilities we have circulated inquiries on surplus inventory, have printed a list of critical items and made it available to all utilities so that they have a guide as to where to go in getting an order filled when suppliers are unable to fill under ratings of A-2 or A-5.

Mr. Skinker: In our case where we have a number of d-c motors for which we have absolutely no use. I did not like to junk them, but I did not know what to do with them.

Mr. Krug: In the case of any equipment that you have that you think would be useful in the war effort, write me and list and describe what you have available. We have set up in the War Production Board a used equipment branch that maintains a master list of all such equipment which is available to each branch. We also now have in the Power Branch a small group trying to place used equipment, wherever possible, in proposed projects that flow through the Power Branch.

If you have d-c. motors or d-c. engines that are usable, it is probable that a place can be found for them in the war program.

(No further questions were offered.)

Secretary Jordan: I think that everyone here appreciates the time and consideration Mr. Krug has given us. We are delighted to get acquainted with him. The discussion will have far-reaching benefit.

New England Association Cancels Poland Spring Convention

The New England Water Works Association, through a mailed ballot, has voted to cancel the Annual Convention which was to be held at Poland Spring, Me., Sept. 15-18.

In its place a two day meeting will be held at Hotel Statler, Boston, June 15 and 16.

The annual business meeting will be held and technical sessions will be devoted to wartime water works problems. The meeting will be pretty much shorn of entertainment and there will be no manufacturers' exhibits. There will be held an annual dinner with modest entertainment but no dancing thereafter as in the past.

SUBSTITUTE AND ALTERNATE MATERIALS FOR SERVICE PIPE

By E. E. SMITH
General Sup't.
Dep't. of Water and Sewerage
LIMA, OHIO

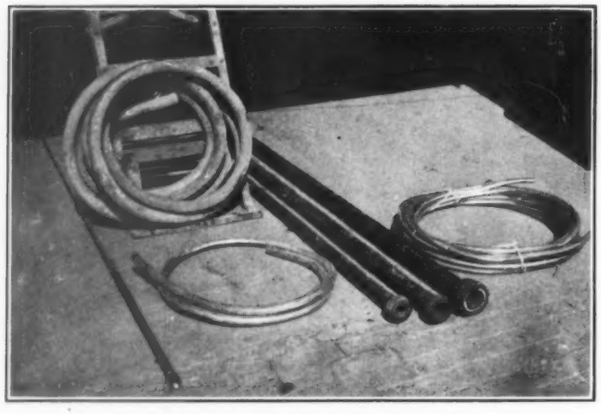
ALTHOUGH the words "Substitute" and "Alternate" are nearly synonymous, they indicate the temporary or the permanent nature of the material involved.

For many years by the majority of water works managers services have been almost exclusively considered as preferably consisting of copper from ¾ to 2 inches, and of cast iron for the larger sizes. These materials have almost universally given results of complete satisfaction in every respect.

The Author*

Copper service pipe was practically removed from consideration for purchase on November, 1, 1941, and it became evident that substitutes or alternates would become necessary as stocks of copper tubing became depleted.

At Lima, every effort has been made in the direction of conserving copper tubing. Only for particular locations, where it has been specifically needed, has it been used. In other locations, where their peculiarities could best be employed, the more readily available materials have been employed. While nothing in this paper is essentially new, a review may suggest possibilities to water works operators faced with the same problem of utilizing other service line materials.



Service Line Materials Now Available

(Left to right) ¾ in. wrought iron, 20 ft. lengths; ¾ in. and 2 in. XXS lead; 1¼ in. and 1½ in. screwed cast iron; 2 in precaulked cast iron; ¾ in. Tubeloy.

Available Materials

The substitute or alternate materials in the service sizes from ¾ inch to 2 inches I.D. are as follows:

XS or XXS lead.

Cast iron in screwed joints—
5, 10 and 15-foot lengths, 1¼ inch diameter.
6, 12 and 18-foot lengths, 1½ inch diameter.
9 and 12-foot lengths, 2 inch diameter.

Tubeloy—
Type "K" in ¾ and 1 inch diameter.
Type "A" in 1½ and 2 inch diameter.

Wrought Irons.

Plastic Tubing.

Advantages and Disadvantages

In detail, each substitute or alternate has its own perculiar advantages and drawbacks, as follows:

Lead requires wiped joints, calling for skilled labor. Is permanent, convenient, ductile, reliable.

Cast iron is permanent, relatively brittle, requires fittings, which are usually malleable, for changes in direction.

Tubeloy is new and relatively without experience, is convenient, can be wiped, flared, or sweated in fittings, probably as permanent as lead.

Wrought iron is strong, tough, requires fittings for more than slight changes in direction. Permanency depends on character of water and durability of fittings.

Plastic tubing is not adapted yet for hot water, nor is it freely available.

Cost Analysis

The comparison of cost per foot is important, so, according to most recent quotations, subject to quantity discounts and market changes:

	Price per ft. in cts., according to I.D.				
Materials	¾"	1"	1¼"	1½"	2"
XS Lead	31	42	53	71	122
XXS Lead	42	53	69	99	172
Cast Iron	..	..	20	22	27
Tubeloy Type "K".....	19	23	39	37	54
Tubeloy Type "A".....	..	..	..	73	120
Wrought Iron	14	19	25	29	40

It will be noted from the above cost comparison that wrought iron services in the smaller domestic sizes are cheapest, tubeloy next, with lead the most expensive. In the larger service sizes (above 1 inch), cast iron is the cheapest, followed by wrought iron, tubeloy and lead. In view of the limited availability of wrought iron, it is possible to assume the desirability of using tubeloy for the small services and cast iron for the larger.

Note: In addition to ordinary wrought iron, cement lined wrought iron or steel pipe is available and should be considered when choosing service line pipe. Naturally, it is somewhat more expensive but much more durable than ordinary wrought iron or galvanized pipe. —Ed.

*Chairman, Ohio Section, A.W.W.A.

Acknowledgment.—This paper, read before the Ohio Section of A.W.W.A., is printed by permission of the Association.

A PLATFORM FOR A. W. W. A. IN THE YEAR AHEAD*

By ABEL WOLMAN
President of A.W.W.A.

MR. PRESIDENT, Ladies and Gentlemen: What I want to talk with you about is just what kind of a platform for A.W.W.A. during the coming year a president really ought to design.

Obviously, for a professional association I do not want a platform which is of a rabble-rousing type. On the other hand in these days of stress, and they are truly days of stress, perhaps unmatched in the history of our country, I can't get very excited about a purely intellectual pursuit of problems which under normal times would be a reasonably fine basis for a platform.

If I might diagnose the interests of the members of this Association, there are several roads which I might travel, several indices which might be useful to me. One of these is implicit in the program of the past week. As I ran through it during the last day or so in the preparation for a possible platform, I found any variety of things on which a man could take a position, but they still do not seem to me to be the logical or appropriate kind of platform for these days of stress.

We live in a shifting world, in a world which is in a terrific struggle between two ways of life. So, I may be pardoned if I depart from an appropriate technical subject to what some people like to call glittering generalities. But in this world these generalities appeal to me at the moment, and I am sure appeal to everyone in this room. There appear to be no substitutes for general truths in times of real crisis. This doesn't appear to be the time for us to discuss the strictly technological aspects of our program. It seems much more fruitful to discuss with you these glittering generalities in the hope that they may be brought home to our membership and around which we may be able to build a platform for this coming year of trial and tribulation.

As I see it, the problem of this Association—to which I want to lend what meager efforts I may have to offer—is to determine where its membership stands with respect to the country as a whole and to society in general. I choose that theme with a definite purpose and perhaps in extending it I may be a little bit more frank than such an occasion normally may warrant. I do it, however, with full understanding that the room is filled with friends—that it is filled with Americans—that it is filled with people who have a due recognition of their responsibilities.

The first and perhaps the only plank in a prospective platform for the Association during the coming year is victory for our way of life. And whether that victory is won by our giving up three-quarter-inch service pipe or failing to extend our pumping stations—or even in spite of the contests for priorities—or if some of our streams remain polluted or if some of our valves are free of copper or brass, or even if we have to give up the metering of water supplies (heaven forbid) I am quite sure that this group—man, woman, and child—will give them up with joy, with understanding and with one truly primary purpose in mind.

This is not solely *my* platform. I am merely taking the liberty of enunciating what I am quite sure you would indicate to me would be *your* platform, if each of you had an opportunity so to state to me.

So, repeating very briefly, the platform, which is yours and which as I say I shall try to follow, is that in our proceedings and, more important, deep in our hearts, humanity will come first. The American Water Works Association's problems will be considered only insofar as they can stimulate and move forward the aims of embattled society. They must come second until our way of life has been adequately secured and permanently protected.

I make this comment because I think we tend, as all of us do in the technical professions, to insulate ourselves from society in general and from common people in particular. That is not a charge; it is perhaps a diagnosis. The professional man long operating at the will of people, long granted special privileges by the people, tends to forget the source or the purpose of that privilege.

I merely aim again tonight—in discussing this within this family party—to recall that we are here by virtue of the common consent of the democratic people of the United States. What they ask of us we must give. We must give it not grudgingly, not hesitatingly, not in criticism, but as servants, as agents of a universal parent. That is the kind of platform on which I am quite sure that this Association will rest in the future as it has for somewhat over 60 years in the past.

The best professional performance of this group is for the good of the people of America. It cannot be limited or encompassed by our own desires, by our professional jealousies, by our insistence on the norms of peacetime periods, by the accumulation of goods in the water works field for the protection of specialized sectors of the continent, by failures to recognize major dangers to all that must be important to us.

That platform likewise implies a shifting from our decimal points to the field of human relations. I have attempted this evening to stress those features of it which are perhaps understressed in normal technical programs, not because they are new or unacceptable to you, but because our daily pursuits sometimes blind us to our present realities and dangers.

The Association will, I hope, move toward the acceptance of the truths of human relations. I need only point out that this is not a hard task for us to pursue. It is on such a platform, ladies and gentlemen, that I hope to ride through the coming year with you.

*Excerpts from the stenotypist's record of an extemporaneous address by the new president of A.W.W.A. at the close of the highly successful Conference on Wartime Problems, Chicago, June 24, 1942.

SEWAGE CHLORINATION FOR ODOR CONTROL

The Effects of Sub-residual Chlorine Dosages on Hydrogen Sulfide Production in Sewage

H. HEUKELEKIAN, Bio-Chemist
DEP'T WATER AND SEWAGE RESEARCH*
RUTGERS UNIVERSITY
NEW BRUNSWICK, N. J.

CHLORINE performs a number of valuable functions in the operation of sewage treatment plants. Not the least of these is the application of chlorine in the control of odors.

Odors in sewage arise from the splitting of sulfates by the action of bacteria in the absence of dissolved oxygen. The reduction of sulfate to sulfide is brought about by a small group of specific bacteria. However, they are widely distributed and become very active under favorable environmental conditions. Probably the most important organism responsible for the production of sulfide from sulfate is the *Vibrio desulfuricans* which has been isolated from sewage.[3] This organism has been described previously as a *Spirillum* or *Microspora*. Up to recently the organism was considered as non-spore forming, but studies by Starkey[3] have shown that the organism can produce spores and manifest considerable morphologic variability. The chlorine tolerance of the organisms is not known but it may be assumed that in the spore state they would require excessively large quantities of chlorine.

Chlorination for Odor Control Well Established

Chlorination of sewage for controlling odor production, introduced by Linn H. Enslow of the Chlorine Institute, has now become well established. The purpose of chlorine application may be: (1) To prevent the formation of sulfides; (2) to destroy the sulfides after they are formed by the reaction between chlorine and hydrogen sulfide. The latter application requires more chlorine and should give precedence to the remedy of prevention whenever possible.

The prevention of sulfide formation by the use of chlorine is dependent on the retardation of the growth of the organisms. Unlike the use of chlorine for sterilization, where a small residual has to be maintained for effective reduction of bacterial numbers, only partial chlorination by sub-residual doses is sufficient in preventing odor production. Griffin[2] reported that at Elizabeth, N. J., the odors in a trunk sewer were controlled by the addition of 8 ppm. of chlorine to the sewage with a chlorine demand of 10-20 ppm. In spite of the widespread use of chlorine for controlling odor production and abundance of published records giving the dosages of chlorine used for effective elimination of odors, there is a dearth of information which correlate the dosages of chlorine applied in relation to the chlorine demand and the corresponding retardation in sulfide production. If such a relationship could be established, greater economies in the use of chlorine for odor control might be brought about. However, since the chlorine demand of sewage fluctuates at different times and at different plants [in addition to the other characteristics of sewage, such as septicity and local conditions] a universal formulation for the effective chlorine dosage on the basis of chlorine demand might be hazardous.

The Author

Another difficulty arises in conducting a laboratory experiment to establish the minimum chlorine demand satisfaction for the prevention of sulfide production. It has been shown by Baumgartner[1] that sulfide production from sewage under laboratory conditions is slower than in the sewers because of the removal of sewage from contact with the slime and sludge deposited in the sewers. Therefore, in any laboratory study on sulfide production from sewage it is difficult to project the results to actual sewer condition in respect to time required to produce similar concentrations of sulfide. It is a question whether a given chlorine dosage to satisfy a certain percentage of the chlorine demand effective in retarding the production of sulfide from sewage under laboratory conditions might be similarly effective in the sewer, irrespective of the difference in the rate of sulfide production under these two conditions.

Another question that might be raised is that if the seat of sulfide production in sewers is the sludge and slime deposits, how can sub-residual chlorine applications be effective in controlling odors since the chlorine demand of the sludge is much higher than that of the sewage? Could the effectiveness of chlorine under these conditions be due to its reaction with the hydrogen sulfide as it is being produced rather than to an actual retarding effect on the development of the organisms included in the sludge and slime?

These and similar interesting questions call for further investigations. This paper does not presume to answer all these questions but to present a few results on the relationship between chlorine dosage on the basis of chlorine demand and sulfide production from sewage.

Methods

Fresh sewage was collected from a municipal plant treating primarily domestic sewage. The chlorine demand was determined and various predetermined dosages of chlorine were added to portions of the sewage to obtain the desired percentages of chlorine demand satisfaction. A number of bottles were filled and stoppered, so that for each determination the contents of one bottle was used. These were incubated at 20° C. and at intervals the total sulfide content was determined by acidification of the sample with sulfuric acid prior to aspiration with carbon di-

*New Jersey Agricultural Experiment Station.

oxide. The hydrogen sulfide evolved was trapped in zinc acetate solution. At the end of two hours of aspiration a definite volume of standard iodine was added to the zinc acetate solution containing the sulfide, the solution was acidified with hydrochloric acid and the excess iodine titrated with standard sodium thiosulfate.

Results

The results of two series of experiments are given in Figs. 1 and 3. The values are plotted on the basis of ppm. total sulfides against the percentage of chlorine demand satisfied after different periods of incubation. In Fig. 1 the effect of varying the chlorine dosages from 0 to 100 per cent chlorine demand satisfaction is presented. The chlorine demand of this sewage was 10.5 ppm. The results show that when sufficient chlorine was added to satisfy *only* 20 *per cent* of the chlorine demand, a definite and significant decrease in the sulfide content was obtained up to 7 days of incubation. To keep the sulfide content below 1 ppm. (a figure commonly used as the maximum value beyond which nuisance is created) for about 4 days, a chlorine dosage equal to the 20 per cent of the demand was sufficient. But 60-80 per cent of the demand should be satisfied to keep the sulfide content below 1 ppm. for 7 days. The addition of chlorine to obtain an initial residual was not sufficient, however, to retard sulfide production below the 1 ppm. value for a period of 9 days. When the amount of chlorine required (on the basis of chlorine demand satisfied) is plotted against the time in days to keep the sulfide content below 1 ppm., a curve is obtained as given in Fig. 2, indicating that there is almost a direct relationship between the chlorine dosage up to 20 per cent of the demand and retardation of sulfide production. To keep the sulfide content below 1 ppm. for two days 10 per cent of the chlorine demand, and for four days 20 per cent of the demand should be satisfied. To retard the sulfide production for six days, however, nearly 45 per cent of the demand should be satisfied. To bring about greater retardation, therefore, relatively larger quantities of chlorine should be applied. This would indicate that the sulfide producing organisms recover after the initial effect of chlorine and in order to obtain greater residual effects greater dosages of chlorine should be applied.

In Fig. 3 is presented the effect of chlorine dosages up to 25 per cent of the demand on the sulfide production. The chlorine demand of the sewage was 12.5 ppm. The results show little if any effect with a dosage equivalent to the 5 per cent demand.

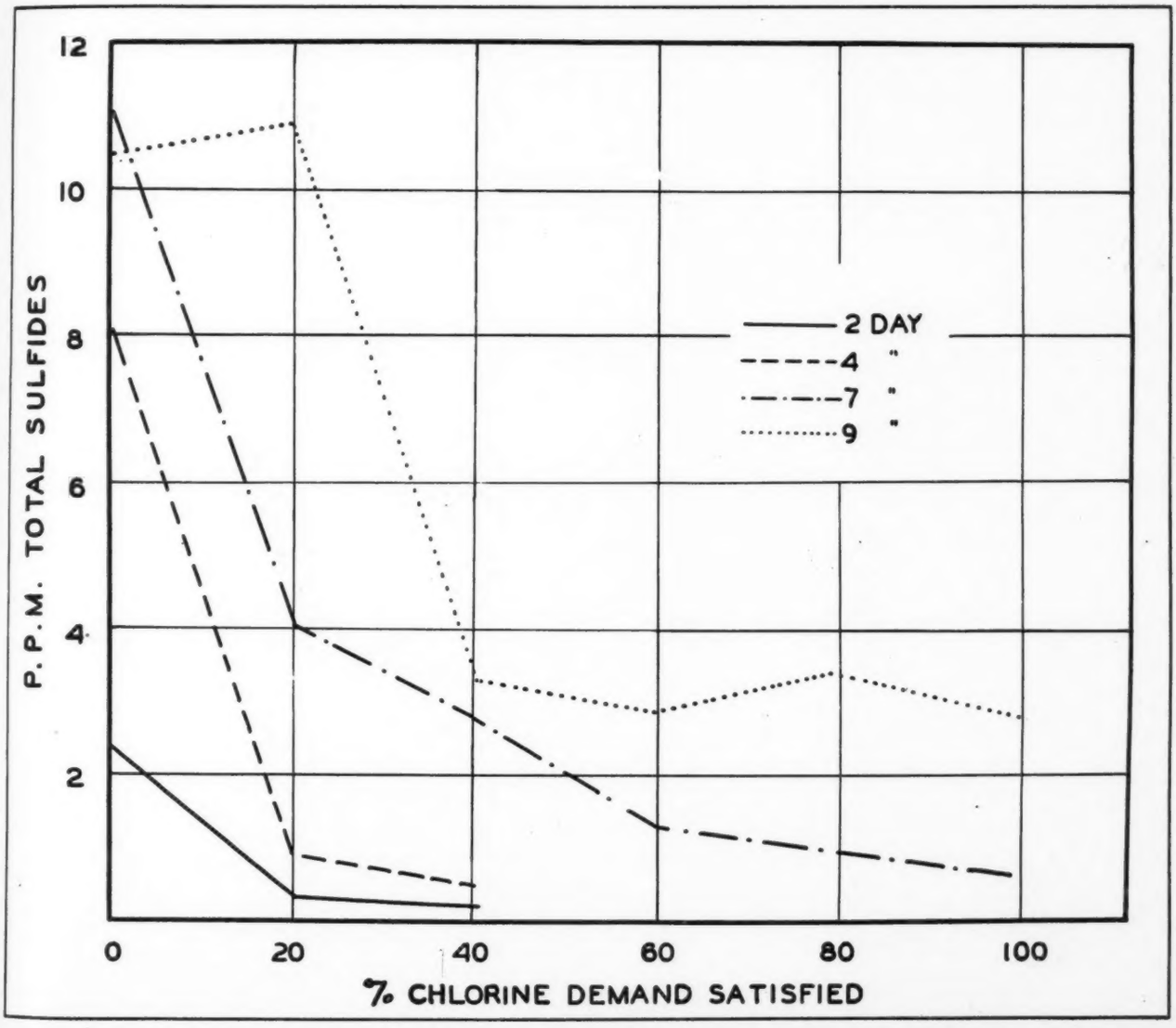


Fig. 1.—Relationship Between Sulfide Retardation and Percent Total Chlorine Demand Satisfied by the Dosage Applied.

When 10 per cent of the demand is satisfied the sulfide content is lower than in the control without chlorine addition for a period of 2 and 4 days, but this dosage has no effect for longer periods. A decided retardation over these longer periods is obtained with a chlorine dosage equivalent to 15 per cent of the demand. Sufficient retardation is obtained to maintain the sulfide content at 1 ppm. for a period of 2-4 days when 20-25 per cent of the chlorine demand is satisfied. For longer periods, dosages larger than 25 per cent of the demand are necessary. The results from the two series check each other closely in this respect. In general, therefore, the chlorine dosage should be regulated according to chlorine demand and with the length of retardation desired.

Discussion

The results show definitely that there is a relationship between the chlorine dosage applied in relation to demand of sewage and the degree of retardation of sulfide production. For shorter periods of retardation, relatively smaller quantities of chlorine are required than for longer periods. To maintain a minimum sulfide content of about 1 ppm. beyond a four-day period requires increasingly greater chlorine demand satisfaction. In general, 20-25 per cent of the chlorine demand satisfaction gives decided retardation of sulfide production, but for longer periods, the residual quantity of sulfide with such dosage is higher than can be ordinarily tolerated.

It is difficult to translate and compare these laboratory findings with actual plant conditions for the following reasons: (1) Field records on the application of chlorine in relation to demand and effectiveness in the reduction of the quantity of sulfide produced are scarce. Published results indicate a chlorine dosage required equivalent to 40-80 per cent of the demand. If the lower figure is taken as the more usual practice, the laboratory findings appear to give a higher efficiency; that is to say, lower chlorine demand satisfaction for effective lowering of sulfide production. This higher efficiency of chlorine under laboratory conditions is to be expected because of better mixing and contact. (2) An additional factor may enter into the picture causing a higher chlorine requirement for effective control of sulfide production in sewers, namely, the effect of sludge deposits and sidewall slime accumulation. It is to be expected that relatively higher sub-

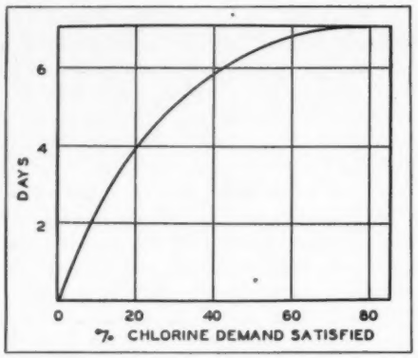


Fig. 2.—Relationship Between Period of Sulfide Retardation and Percent Total Chlorine Demand Satisfied in the Application.

residual chlorine dosages will be required for equivalent retardation of sulfide production when such deposits are present. The magnitude of this factor in determining the effective chlorine dosage is not known. However, with and without chlorination this factor is so vital as to change the rate of sulfide production from a period as measured by hours of flow in sewers to days in the laboratory.

Sufficient has been said, however, to make a strong plea for more information. Such information should include the minimum effective dosage of chlorine in terms of chlorine demand satisfaction on the control of odors preferably by actual measurements of sulfides in sewage. Such a study should be made preferably under plant conditions and should include among other things the length of retardation with different dosages and the effect of slime and sludge deposits on the effective dosage.

Summary

Laboratory experiments on the effect of application of chlorine to sewage below residual values on the production of sulfides were conducted. The results expressed on the basis of the chlorine demand satisfied show that a chlorine dosage equivalent to 5-10 per cent of the demand is not sufficient to retard sulfide production. A minimum of 20-25 per cent of the chlorine demand should be satisfied to keep the sulfide content below 1 ppm. for a period of 4 days. If longer periods of retardation are necessary, increasingly greater percentage of demand should be satisfied. The effect of certain variables under practical conditions existing in sewers in relation to this study is discussed and need for further investigations is stressed.

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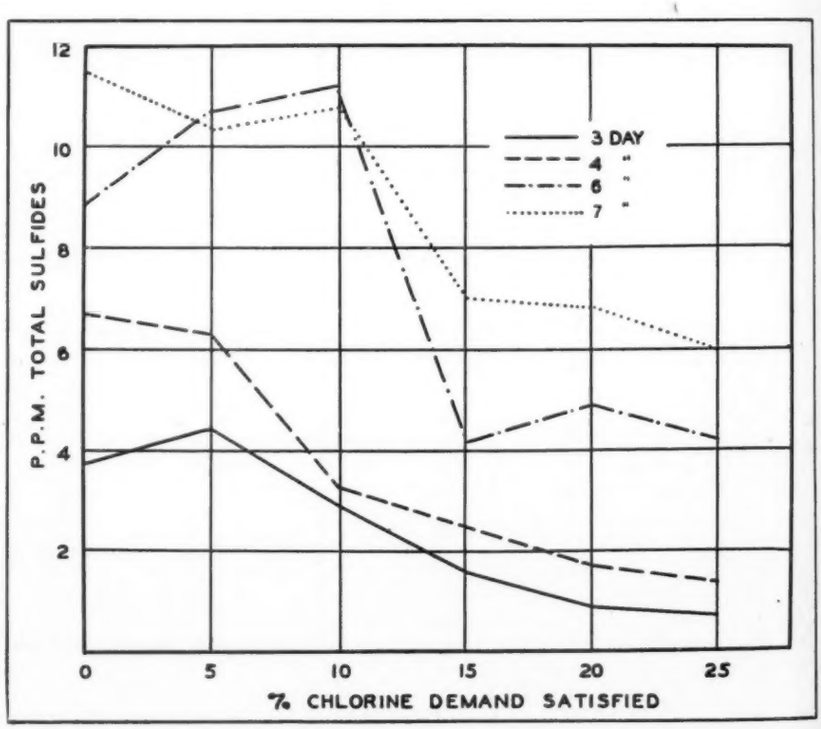

Fig. 3.—The Effects of Chlorine Dosages up to 25 % of Total Demand on Sulfide Production Over Various Periods.

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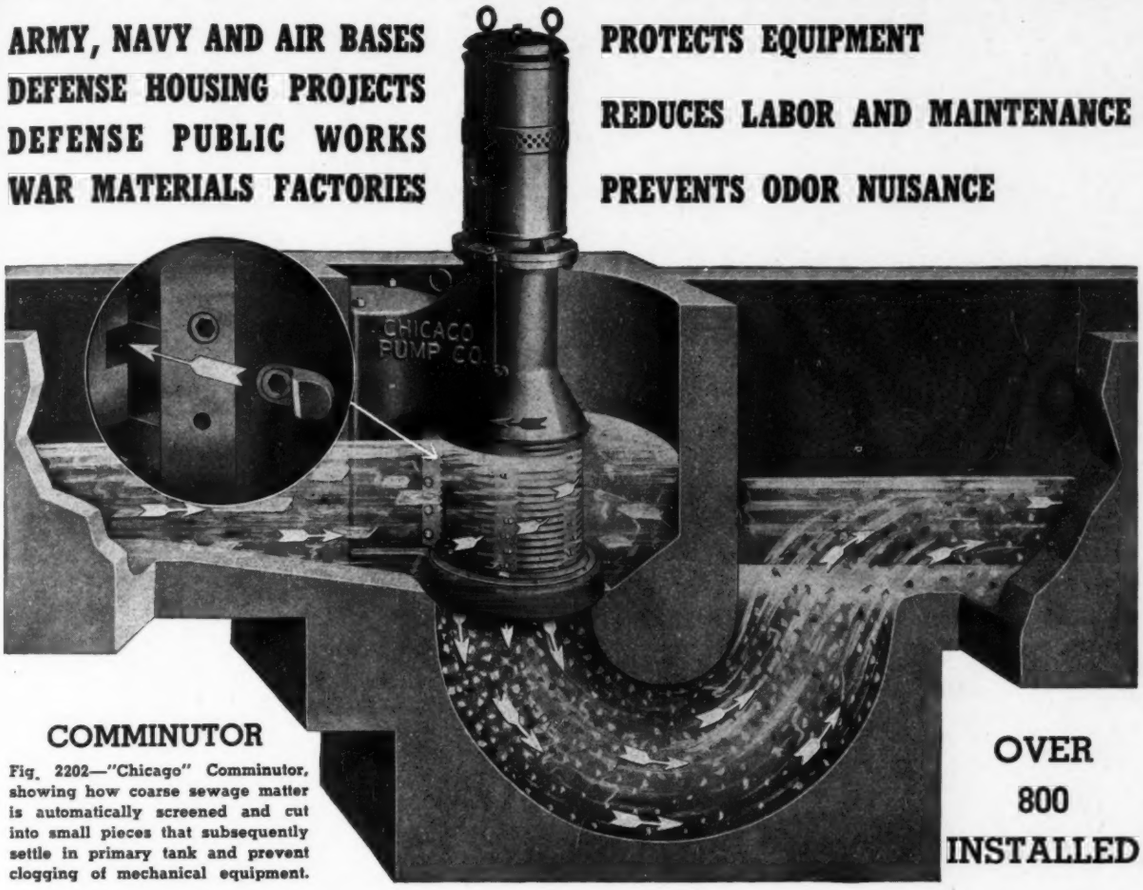

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Fig. 2202—"Chicago" Comminutor, showing how coarse sewage matter is automatically screened and cut into small pieces that subsequently settle in primary tank and prevent clogging of mechanical equipment.

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Beyond..

THE SCOPE OF A SCREEN ANALYSIS

If one has the choice of sweeping a floor with a rake or a broom, obviously the broom will be the implement chosen. The prongs of the rake are plenty strong enough to remove the dirt from the floor but since they can't cover the entire surface their strength is wasted.

Just so with activated carbon in the water plant. That is, a carbon small in particle size and light in weight presents immeasurably more effective surface for removing taste and odors. We describe this property as "dispersion." For use in water plants, the dispersion of activated carbon represents a very important feature by working hand in hand with the carbon's activity for removing taste and odors.

Microscopic study reveals the physical characteristics of activated carbon. Work recently conducted by a commercial microscopist gives the following results in particles per gram for various activated carbons being offered for water treatment:

CARBON	Billions of particles per Gram	Average particle size (Diameter in microns)
A	10.0	3.85
B	28.4	2.7
C	72.0	2.0
AQUA NUCHAR	120.0	1.65

Since the ultimate particle size of AQUA NUCHAR Activated Carbon is extremely fine, it readily separates on dispersion. Many of these smaller particles are aggregates of still smaller particles so that the microscopic count gives us a more effective picture than a screen analysis in showing how these particles break away from one another to form individual units for thoroughly sweeping up taste and odor bodies present in water.

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Thirty-seven years ago the city officials of Columbus, Ohio, authorized the construction of a cast iron sewer force main more than a mile long and 4 feet in diameter. Since that time, 160 billion gallons had been pumped through this cast iron line without one cent of maintenance cost on the pipe.

Recently the city completed a new sewage treatment plant and large intercepting sewer, making the old main unnecessary for further duty. Since it was cast iron pipe, it was possible to salvage 1150 tons of material for either re-use or re-sale. The pipe was sold at a substantial price per ton, representing *an extra-dividend to the taxpayers* of Columbus.

It is impossible to foretell future requirements or population shifts in metropolitan cities but any public official can be sure that, when water or sewer mains must be abandoned or rerouted, the pipe can be salvaged or re-used, *if it is cast iron pipe.*

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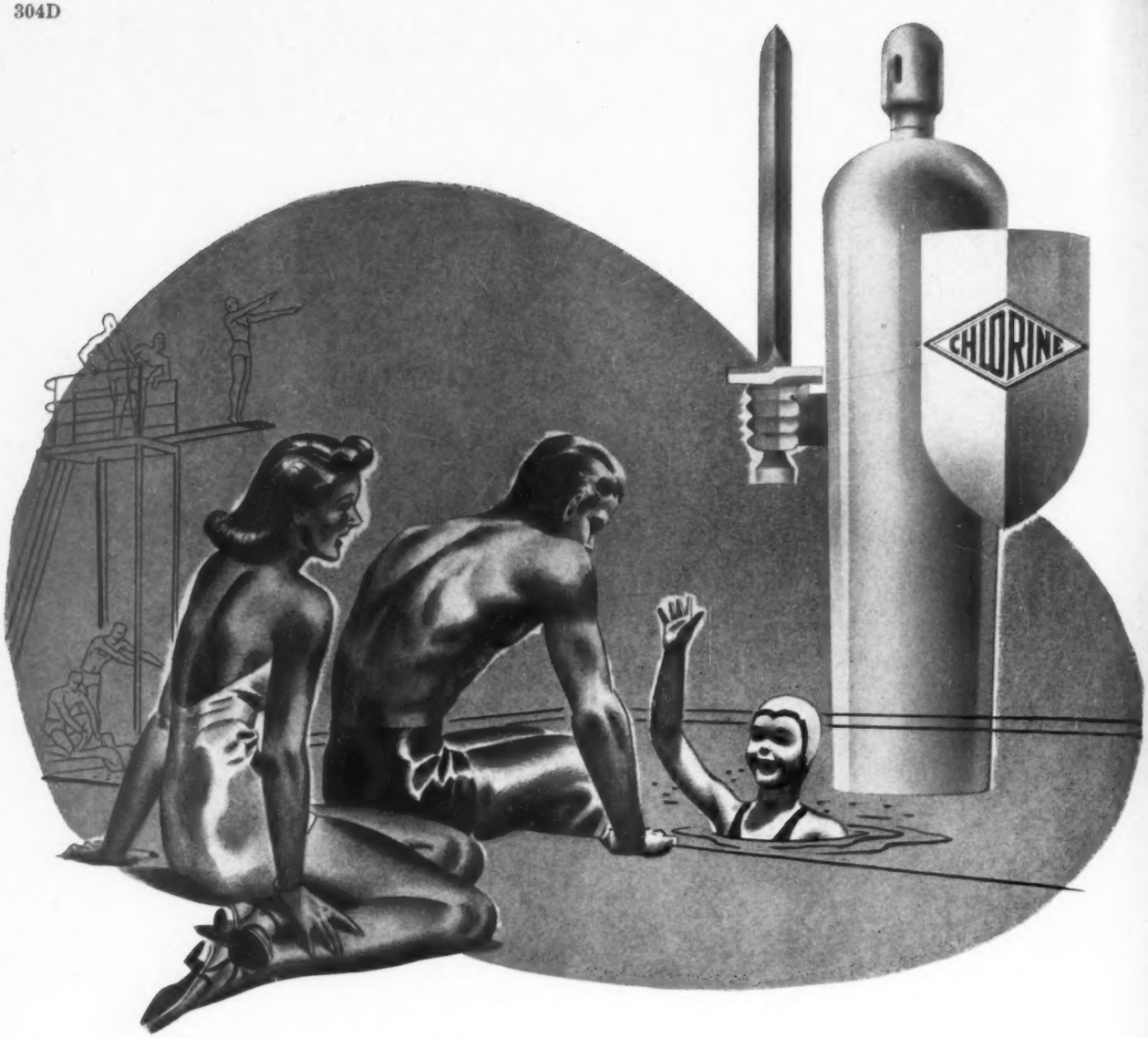

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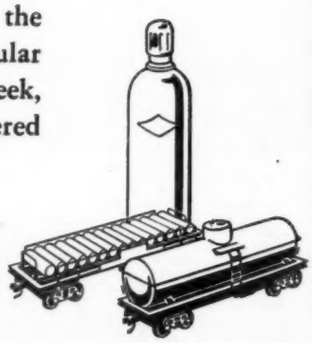

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MARYLAND-DELAWARE ASSOCIATION'S SIXTEENTH ANNUAL CONFERENCE

Technical Papers Evaluate Vulnerability of Water Systems and Present Reassuring Data

By HARRY A. FABER*
Associate Editor

SERIOUSLY concerned with war time problems, some 130 members and guests of the Maryland-Delaware Water and Sewerage Association met in Hagerstown, Md., on June 7 and 8 for their sixteenth annual conference. Engineering, administrative, chemical, and bacteriological aspects of the defense program all received discussion. Many vague worries were answered with facts, and much reassuring new data was made available. This was essentially a practical meeting, well worth the time of busy utility officials and plant operators.

J. M. Jester, Division Engr. Wash. Suburban Sanitary Distr. Hyattsville, Md. (Retiring Pres.)

R. A. Norris, Chief Engr. Springfield State Hospital Springfield, Md. (New President)

Restrictions on plant visitors were evident in that identification passes were required for those desiring to make inspection trips, but the Potomac River Water Treatment Plant, Williamsport, and the Hagerstown Sewage Treatment Plant were open to all properly qualified. The annual banquet, followed by a floor show and dancing, was held on the first evening of the meeting. The ladies' entertainment committee held a bridge luncheon and conducted a tour of the art museum. Golf arrangements were made at the fine Fountain Head Country Club.

*Research Chemist, The Chlorine Institute, Inc., New York, N. Y.

Officers Elected

The following officers were elected to serve for the coming year:

President

R. A. Norris, Chief Engineer, Springfield State Hospital, Sykesville, Md.

First Vice-President

R. J. Stewart, Service Division, Edgewood Arsenal, Edgewood, Md.

Second Vice-President

E. C. Cromwell, Sewage Treatment plant, Baltimore, Md.

Secretary-Treasurer

J. H. Schilpp, Sanitary Inspector, State Health Department, Baltimore, Md.

Members newly elected to the Executive Committee are: R. C. Willson, Chemist, Water Treatment Plant, Hagerstown, and J. M. Jester, Division Engineer, Washington Suburban Sanitary District, Hyattsville, Md.

The Association has held a short school for water works operators each two years and had planned to hold one in 1942. However, Carl Hechmer, Chairman of the Short School Committee, reported that the University of Maryland has adopted a full year work plan for the duration. Since facilities ordinarily used thus become unavailable; because transportation is limited; and due to the extra duties which must be assumed by instructors, it appeared inadvisable to hold the school at this time. Postponement of this activity until a more propitious time was voted by members.

Carl J. Lauter Supt. Filtration Washington, D. C. (Retiring Sec'y)

R. J. Stewart, Supt. Utilities Edgewood Arsenal (1st Vice-Pres.)

Technical Papers

"Can American Water Systems Provide Adequate Civilian Defense?" by Kenneth J. Carl, Engineer, The National Board of Fire Underwriters, New York City.

This paper by Mr. Carl is of such timely importance that permission for its prompt publication in WATER WORKS AND SEWERAGE was granted by the Association. It appeared in full in the May issue, to which those

Snapped in Sessions

(1) Corydon has the floor. (2) Some intent listening to U.S.P.H.S. Tarbett by Noble Owings, Wash. Suburban San. Districts Asst. Chief Engr., and (right) Humphrey Beckett, Supt. of Water, Washington, D. C. (3) At the Registration Desk, retiring Secretary Lauter, the new Secretary, J. H. Schilpp, Md. State Dept. of Health, Sarah Penington of the Hagerstown Water Dept. (4) Hedgepeth does a little sketching for the benefit of Charlie Bruce, Supt. of Water, Cumberland, Md.—a past-president of the Md.-Delaware Association. (5) Up near front Annapolis' Supt. of Sewerage C. G. Webber, and busy taking notes for this report is Harry Faber, Research Engr. for the Chlorine Institute and Associate Editor of W.W.&S.

readers who have not already studied it are referred.

Briefly, Mr. Carl evaluated detailed studies and reports on more than 450 American cities. His statistics reveal that because of our greater emphasis on fire protection, our systems should be able to cope with requirements of civilian defense in time of air raids better than those of England. Even where a main of 6 to 8 inch size is completely ruptured, the residual pressure outside a radius of about 500 feet of the break would generally be ample to supply adequate flow from a 50 foot garden hose into the attics of residences. On larger mains, the area of inadequate pressure would be somewhat more extended but would probably be ample for the same purpose beyond a 1,000 foot radius of the rupture.

It might well be emphasized that Mr. Carl stressed the advantage of speed in effecting shut-offs of damaged areas. With all other factors equal, this will depend upon the number of valves to be closed. Supply mains are not likely to be seriously damaged and during an emergency it is highly probable that adequate pressures can be maintained for civilian defense against fires and incendiary bombs, because of the design of American systems to insure liberal fire flows at low pressures.

"Emergency Disinfection of Public Water Supplies and Mains," by H. W. Streeter, Senior Sanitary Engineer, U. S. Public Health Service, Cincinnati, Ohio.

Emergencies create a problem distinct from routine treatment, Mr. Streeter pointed out. We already have considerable experience with emergencies due to natural causes or accidental contamination, but no experience with aerial bombardment. Usually we have no opportunity to prepare for conditions created by natural or accidental contamination, but we do have ample warning and experience abroad to provide a basis for our war time emergency plans.

Emergency facilities should be provided to enable feeding a chlorine dose two to three times that ordinarily required. It might be necessary to maintain a residual of 0.8 to 1.0 ppm. in the finished water for a period of at least two weeks during emergencies. At least one portable or mobile chlorinator should be available.

The Public Health Service on Parade
Major Geo. E. McCallum, Regional Engr., O.C.D.; Commander Ralph E. Tarbett, Sr. Sanitary Engr.; Lieut.-Col. Harold W. Streeter, Sr. Sanitary Engr.

One individual should have emergency authority, the system should be mapped in detail, squads of trained men should be available for emergency disinfection, truck or other transportation must be coordinated, and laboratory supervision should be planned. At the first emergency alarm, or even before the alarm, if an emergency can be anticipated, the chlorine dose should be increased. Prompt action is necessary since negative pressures may result from sudden drafts due to main breaks or fire fighting demands. An auxiliary water supply should be prepared and tank trucks with means for disinfection should be available.

Repaired mains should be disinfected, the heavily chlorinated water being allowed to remain for 24 hours before the system is again used. If a polluted supply is pumped to reservoirs for fire fighting, that water should be heavily chlorinated. Secondary chlorination of reservoir effluents provides an additional factor of safety.

Residual chlorine should be present in tank trucks upon delivery of the water. One ounce of 33 per cent bleaching powder will provide a dose of 2.5 ppm. when added to 1,000 gallons of water. This dose may not be adequate for polluted waters, since usual chlorine residuals below the breakpoint have been found to be less dependable than those existing when the total chlorine demand of the water is satisfied. During emergencies it is recommended that high residual chlorine concentrations should be maintained even at the expense of tastes. Safety is the paramount consideration at such times and few individuals will complain about potability.

Should it be quite impossible to obtain chlorine in any form, the excess lime method of treatment may give some degree of disinfection. The length of contact time must be increased beyond that required with chlorine if this treatment is to be effective. After the emergency has passed, all old water in the system should be replaced and a bacteriological check should be made before conditions are considered normal.

In discussing Col. Streeter's paper, *Jeff Corydon* (Proportioneers, Inc., Providence, R. I.) described one type of mobile unit developed to supply emergency chlorination equipment. The specifications for this type of unit should include simplicity, flexibility, high capacity and ruggedness. An 85 h.p. Ford engine operates a 400 g.p.m. pump to provide potable water or water for fire fighting, while four chemical feed machines may be used with the pumping unit or for separate applications in the "blitz buggy" described. Mr. Corydon pointed out that special equipment can readily be made from standard parts to meet the requirements of each local situation. These units will also have definite applications in peace time as well as during emergencies.

N. S. Chamberlain (Technical Service Division, Wallace & Tiernan Co., Newark, N. J.) pointed out that measurement of high chlorine residuals is a problem in the superchlorination treatment of mains or polluted supplies. Recent study has disclosed the fact that the ratio of ortho-tolidin to residual chlorine must be about 3 to 1 in order to yield proper colorimetric results. By

(1) J. L. Hart, U. S. Pipe, Phila., and "Mike" Glace, Cons. Engr., Harrisburg, Pa. (2) Norman D. Kenny of Whitman, Requardt & Smith, Engrs., Baltimore and Pittsburgh Meters; Ed. Eilers, also from Baltimore (but don't let this pose deceive you, Kenny wasn't really in need of Eilers' broad shoulders—at least not when this picture was taken). (3) R. J. Stewart, Supt. of Utilities, Edgewood Arsenal, Md. (1st Vice-Pres. of the Ass'n) with "Ted" (E. M.) Wilson of Penna. Salt Co. (as camera-shy as they come). (4) E. L. Starr and C. A. Hundley, Water and Sewage Plant Operators, Edgewood Arsenal, Md. (5) Mathieson Alkali's Bill Eastburn (Phila.) and "Ducky" (L. S.) Duckworth, Supt. of Filtration Plant and Pumping Stations, Lancaster, Pa.

using an indicator solution containing 1.5 grams ortho-tolodin dihydrochloride, 200 ml. hydrochloric acid, and 800 ml. of distilled water, a sufficiently high acidity is provided and the dihydrochloride is readily soluble. In ordinary testing, a deficiency of indicator produces red color at low (beyond 10 ppm.) chlorine concentrations, but true colors may be obtained to check with standards up to 250 ppm. if the proper ratio of indicator to chlorine is maintained. Color slides were used to illustrate results of this technique.

In reply to a question, *L. L. Hedgepeth* (Technical Service Department, Pennsylvania Salt Mfg. Co., Philadelphia) stated clearly that there is no excuse for any water supply to lack adequate chlorine for normal operation and even for reserve needs. Principally at fault for difficulties in obtaining chlorine is the individual who places the order, since adequate supplies are set aside by the producer. Each order must specify the proper priority rating and certify as to the use. Reserve materials can be slowly accumulated by so specifying in orders. When properly executed and signed orders are received before the 10th of the

Noel S. Chamberlain, Chemist Technical Service Dept., Wallace & Tiernan Co.

John C. Geyer, Assoc. Prof. of Civil Engineering Johns Hopkins Univ., Baltimore.

Kenneth J. Carl, Field Engineer, Nat'l Board of Fire Underwriters, N. Y. City

month preceding the month of delivery, chlorine must be supplied by the manufacturer. The A-2 rating, assigned to water supply chlorine will provide adequate liquid chlorine or any form of hypochlorite. The A-6 rating assigned to public swimming pools will provide adequate liquid chlorine or chloride of lime. The A-10 rating assigned to private swimming pools gives little chance for chlorine in any form to be obtained.

"War Time Possibilities of Water Supply Contamination," by Harry A. Faber, Research Chemist, The Chlorine Institute, Inc., New York, N. Y.

Much public concern has been

Host
R. C. Willson, Chemist Hagerstown Water Dept. (Program Chmn.)

"Wheel Horse"
Carl A. Hechmer, M. & O. Engineer Wash. Suburban Sanitary Distr. (Short School Chmn.)

caused by the possibility of deliberate contamination of water supplies by war gases or through sabotage, and little factual data is available. No records show poisoning of water supplies to have been attempted in this or in the first world war. No gas was dropped from airplanes in the last war and contamination of water supplies by this means does not appear a very likely possibility. Only a few war gases are toxic in amounts which might conceivably be used and if these were present in sufficient concentration it is obvious that a large area would probably be made untenable.

Specific tests for detecting the presence of such gases have been developed by Army officials and will be available to various State Department of Health laboratories. Nonspecific tests for contamination are simple and can be made a routine part of plant control. Nearly all of these gases increase the chlorine demand of water, and this condition may be used as an indication of pollution which should be investigated in detail.

So far, saboteurs have not appeared to find poisoning of water supplies an attractive activity. No such attempts have been made in England or in Canada, as far as can be determined. Studies have shown that the introduction of effective concentrations of toxic substances into a distribution system would not be simple; large amounts of most poisonous materials would be required. These are generally difficult to obtain and the results would be uncertain. The fatal dose of such chemicals is generally larger than might be expected and variations in individual susceptibility would probably indicate the presence of the poison before damage became extensive.

A competent technician would be required to accomplish bacterial contamination, and the presence of residual chlorine provides considerable protection against this form of sabotage. Frequent tests for residual chlorine throughout the distribution system will be most desirable and chlorine demand tests would indicate the use of dechlorinating agents.

Water treatment plants should be operated at their maximum efficiency, since storage, good coagulation and sedimentation, the use of large doses of activated carbon, and heavy chlorination provide the best purification methods for either normal or emergency pollution. No complete protection of such a vulnerable utility is possible, but the danger to any individual supply is very small. A practical approach to this problem shows that every reasonable precaution should be taken but that its possibilities are not great.

In reply to a question by *C. G. Weber* (Superintendent, Sewage Treatment Plant, Annapolis, Md.), Mr. Faber stated that protection of chlorine containers against direct hits by bombs did not appear to be feasible. If the containers are stored in heavily populated areas, protection against bomb fragments as is done at Buffalo might be desirable.

Albert Tawney, Supt. Water and Sewage Works, Fort Mead, Md.

L. L. Hedgepeth, Director Technical Service, Penna. Salt Mfg. Co., Philadelphia.

Harry H. Hall, Chief Engineer, Wash. Suburban Sanitary Distr., Hyattsville, Md.

Not only are the chances of direct hits highly unlikely, but under conditions of severe bombardment released chlorine would generally constitute only a minor hazard. A fire would probably accompany the bombing, and because of the draft of air created, would help remove chlorine gas. Liquid chlorine no longer under pressure would not volatilize rapidly and lime could be used to absorb at least a part of the chlorine.

"Emergency Iodine Sterilization," by John W. Krasauskas, Bacteriologist, Dalecarlia Filtration Plant, U. S. Engineers Office, Washington, D. C.

Mr. Krasauskas noted that C. J.

Lauter, Chemical Engineer, and G. H. Harrington, Chemist, of the Dalecarlia plant were joint authors of this paper. Because the literature is very vague as to this application, these studies were undertaken in order to determine the practical possibilities of emergency disinfection with iodine. Earlier data related to the effect of iodine on pure cultures of bacteria rather than on bacteria in natural waters containing organic matter.

Standard U. S. P. 7 per cent tincture of iodine was employed in these tests, the dose being measured in drops per quart of water sample. After contact periods of 5, 15 or 30 minutes, sodium thiosulfate was added to stop action of the iodine, and samples were taken for bacteriological examination.

Twenty-five samples of raw water from various points in the District of Columbia and in Maryland were studied. Only when an iodine dose of eight drops per quart was used did all samples show sterility, smaller doses could not be depended upon. This result was accomplished in the 5 minute contact time, but 15 minutes contact is recommended for safety. More than three drops of iodine per quart will give water a taste and perhaps a color; sodium thiosulfate may be used to remove excess iodine after the reaction period.

The authors indicated sterilization with iodine to be a last resort, desirable only if heat is not available. Bringing water to a boil and heating for 2 to 5 minutes is a more certain method of emergency disinfection.

F. S. Smith, Engineer, Maryland State Department of Health, Baltimore, and *Major E. S. Hopkins*, Filtration Engineer, Montebello Filters, Baltimore, discussors of this paper, presented the results of independent investigations of the same subject.

Seven per cent tincture of iodine solution was used by Mr. Smith in his studies of 15 surface water sources. He concluded that only waters having a turbidity under 5 ppm. and a color under 10 ppm. could definitely be disinfected. Doses as high as five drops in one liter were used. An objectionable taste was noted long after treatment unless samples were treated with thiosulfate; however, if more than one crystal of thiosulfate was added, a different taste, also objectionable, was present. He also recommended that iodine disinfection be utilized as a last resort.

Major E. S. Hopkins reported iodine efficiency to vary widely in different water samples with relation to the concentration of organic matter. While any dose above five drops per quart produced objectionable color and taste, no less than seven drops per quart was dependably effective on either artificially inoculated or raw water samples. He did not advocate the use of iodine for emergency sterilization. As a matter of record, Major Hopkins noted that the city of Baltimore has constructed fifteen portable chlorinators and that one unit is assigned to each emergency district. Because the city uses prechlorination, with a twelve hour contact period, increase in chlorine dosage is not considered necessary at present.

Albion B. Bailey, Acting Supt. Filtration, Baltimore, Md.

John W. Alden, Chief Engineer, Newcastle Co., Wilmington, Del. (Member of Executive Comm. of the Ass'n)

Leon S. Duckworth, Sup't of Plants, Lancaster, Pa.

"Organizing a Water and Sewage System for Defense," by C. A. Hechmer, Maintenance and Operating Department Engineer, Washington Suburban Sanitary Commission, Hyattsville, Md.

Mr. Hechmer stated that in line with defense recommendations, chlorine residuals had been increased in his system. The extra 0.2 to 0.3 ppm. residual has evoked no complaints from consumers and does provide additional protection.

The water utility official should insist upon his rightful place in the Civilian Defense organization. Mr. Hechmer believes a higher degree of cooperation to be needed since the water supply seems to have received too little consideration from this group. Its importance should be better realized by both the public and the OCD.

Difficulties will be encountered in the functions of the water utility if total war is brought to this country. If maximum protection of the public is to be attained, coordination with the facilities of the OCD and with other utilities must be accomplished.

To protect against sabotage, the guarding and floodlighting of plants and structures is visible defense. Passes and identification should be provided for employees, with keys to locked vital equipment issued only to those who should have access to such units.

Organization of the distribution system into districts and the designation of district authorities is essential if quick shutoffs or repairs are to be carried out. In Hyattsville the entire staff and all equipment has been decentralized. This adds both speed and protection to maintaining uninterrupted service.

Men at each district headquarters are already experienced at emergency disinfection since this application is only an extension of the practice (long established) of chlorinating new mains. The community has 20 emergency supplies, 5 portable pumps and chlorinating facilities are provided for each pump.

R. E. Tarbett (Senior Sanitary Engineer, U. S. Public Health Service, Washington, D. C.), in discussing Mr. Hechmer's paper, said that a special arm band for identification of utility employees is now available. He recognized a serious lack of recognition and consideration on the part of federal authorities for the protection of water systems and their importance. Cooperation between the OCD and water utility organizations is imperative.

"Some Problems Encountered in Removal of Grease from Sanitary Sewage at Army Posts," by John T. Norgaard, Repairs and Utilities Branch, Corps of Engineers.

Mr. Norgaard described in great detail the extensive research required to design standardized layouts of grease traps which would really function in collecting grease. Modifications and new types were described by means of slides, and successful conversion of some 2,600 existing installations was illustrated. The new traps collect about 1 pound of grease per capita per day; at 3 cents per pound this gives a potential return of $27,000 per year from each 35,000 man post; the traps will pay for themselves in three months.

"The Construction Industry in a Nation at War," by Sullivan W. Jones, Chief, Housing Priorities Branch, War Production Board, Washington, D. C.

Many significant and stupendous figures were cited by Mr. Jones in describing our enormous construction program. The 1942 requirement for war construction is over 17 billion dollars—an amount sufficient to rebuild New York City three times, or to build a four-track subway around the earth at the equator.

Some of the construction problems

(1) "Red" (F. B.) Griffeth, Distr. Engr., Wallace and Tiernan Co., Washington, D. C. (2) C. G. Webber, Supt. of Sewerage, Annapolis, Md. (3) Al. Brumley, Stuart-Brumley, Inc., Balto., Md. (4) Major Joe Gilbert, Sanitary Corps, U. S. A., Washington. (5) D. S. Masson, Maint. Engr., Wash. Suburban San. Distr., Hyattsville, Md. (6) "Dick" (R. E.) Wagner, President, Zeolite Chemical Co., Medford, N. J. (7) E. B. Shiddell, Sales Engr., Electro-Rust-Proofing Co., Philadelphia.

created are equally stupendous, brought about by location of defense plants distant from existing utilities. To serve the new Willow Run Ford Bomber Plant, where 30,000 homes are needed, requires 24 miles of cast iron water pipe (up to 48 inches in diameter) in order to connect with the Detroit water supply. Problems connected with demands for steel, lumber, and many other basic materials were described in some detail.

Cast iron and steel pipe will probably be largely replaced by asbestos-cement pipe. House piping may be fabricated of glass. Bath tubs of plywood and "gunnite" are already being made, and there is no reason why they cannot be made of plastic. Showers in new housing units are now made of asbestos with a light metal base. Not only will metals be allocated in the future but, Mr. Jones believes, the allocation of labor may become almost as universal.

"Functions of the Defense Public Works Administration," by John C. Geyer, Associate in Civil Engineering, Johns Hopkins University, Baltimore, Md.

Modifying the original title of his paper, Mr. Geyer described by means of slides how static levels of ground water have declined in the vicinity of Baltimore because of increasing demands. While ground level pressures began to lower about 1900, the industrial use did not increase rapidly until about 1937. Probably more than 1,000 wells have been drilled and several hundred are still in use. Levels have now been reduced over 100 feet and salt water contamination is becoming serious.

Conservation methods—regulation of pumping and sealing of abandoned wells to control chloride encroachment—are expensive and difficult. Many industries already require city water and the demand will continue. Both extended study of this problem and rationing of water use will be necessary to solve this problem.

"Conference on Wartime Sanitation"

To Be Theme of Third Annual Meeting of Sewage Works Federation in Cleveland, October 22-24

Wartime problems in the field of sewerage, sewage treatment and general sanitation will occupy the attention of those who meet at the Hotel Statler, Cleveland, Ohio, October 22-24, for a "Conference on Wartime Sanitation." In announcing plans for this session, the Convention Management Committee of the Sewage Works Federation stressed the importance of this mobilization of engineers for the purpose of conferring on the pressing emergency measures which daily face municipalities, states and the Federal government.

The program will be exclusively devoted to wartime problems and the leading authorities of the country will offer advice and guidance to operators, superintendents, chemists, engineers, and others attending.

In view of the importance of priorities for construction, repair, materials and equipment, the Federation will follow the lead of the A. W. W. A. in arranging a "Priorities Clinic," at which time authorities will be on hand throughout the Conference to answer specific questions and interpret existing priority regulations as they pertain to equipment and materials needed in the maintenance and operation of sewerage systems and treatment plants. This service, coupled with a manufacturers' exhibit of available equipment and substitutes, will provide members with an important backlog of information to bring back to their individual communities.

Among the subjects scheduled for discussion are: The Impact of War on Sewage Treatment Problems: The Need for Short Training Schools During the Present War Emergency; Operation of Sewage Treatment Plants in Military Cantonments; Wartime Sanitary Problems of the State Health Department; Sewage Works Priorities; Civilian Defense Problems; Symposium on Sewage Plant Maintenance in Wartime; Round Table on Laboratory Control of Sewage Works.

The Convention Management Committee is composed of—

William L. Havens, Chairman.

John J. Wirts, Vice Chairman.

F. P. Fischer (Local Finance).

Clinton Inglee (Entertainment).

W. J. Orchard (Financial Advisory Comm.).

A. H. Niles.

Arthur S. Bedell, Ex-officio Member.

Arthur T. Clark, Ex-officio Member (Exhibits).

Chas. A. Emerson, Ex-officio Member.

W. H. Wisely, Ex-officio Member.

SLUDGE DIGESTION TEMPERATURE CONTROL WITH LIVE STEAM

By A. M. RAWN*
Chief Engineer and General Manager
County Sanitation Districts
of Los Angeles County
LOS ANGELES, CALIFORNIA

THE accelerated rate of sewage sludge digestion at temperatures ranging from 85 to 95° Fahrenheit necessitates the application of external heat to the digesting sludge mass. Currently, in most plants the heat is applied by circulating water of a given temperature through metal coils appropriately located on the interior walls of digestion tanks, or suspended in the sludge itself. The water may be jacket water from gas engines or constantly recirculated water heated in boilers of required capacity. Circulation is usually accomplished by pumping.

If fuel is at a premium, as, for instance, if power is generated from sludge gas at the treatment works and the entire gas supply is conserved for power generation, circulation of the gas engine jacket water presents definite advantages, and the difficulties attendant upon circulation of hot water through coils in the sludge mass is entirely warranted; but if there is a moderate excess of fuel which cannot otherwise be utilized in the operation of the plant or its features, it appears that there is another and better way of adjusting sludge temperatures.

The Author

Disadvantages of Coil Heating

Some of the disadvantages attendant upon heating sludge with circultaing hot water in coils are:

1. Cost of the coils.
2. Cost of pumping circulating water.
3. Removal of scale from exterior of coils as well as at times the interior.
4. Inflexibility of the operation, that is, the inability to heat sludge at any place but in tanks built and equipped specifically for that purpose, or to compensate for the difference between winter and summer sludge temperatures.
5. The periodic dosing of cold sludge into warm sludge mass.
6. Galvanic corrosion causing coil hangers to fail, allowing the coils to sag and leak or drop down.

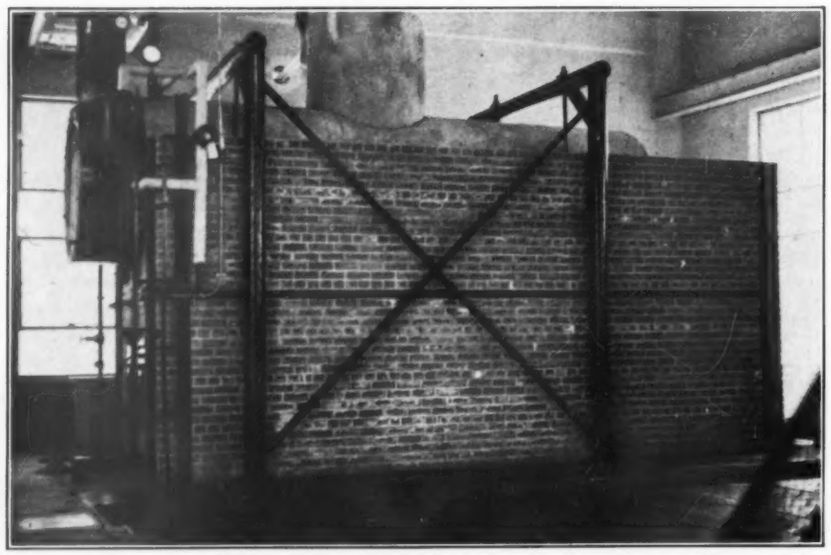
Beginning in 1930, and up until last March, practice at the Joint Disposal Plant of the Los Angeles County Sanitation Districts has been to heat digesting sludge by circulating hot water through cast iron pipe coils attached to the walls of the multi-stage sludge digestion tanks. While the process has been successful, it has exhibited all of the shortcomings hereinbefore noted but No. 6, which has occurred elsewhere. The most annoying deficiency has been the incrustation on (and within) the pipe coils, necessitating progressively higher water temperatures with correspondingly accelerated incrustations, ad infinitum, and the inability to maintain proper temperatures in the digesting mass throughout the year because of wide temperature range in the raw sludge from winter to summer.

Use of Live Steam for Direct Heating

Three or four years ago experiments were commenced at the plant looking toward the possible use of live steam for sludge heating. The experiments were moderate in scale and were aimed principally at ascertaining whether or not live steam would, through partial sterilization of the input of crude and seeding sludge, retard digestion. The information gained from this work was so conclusive as to the advantages of the method that a decision was made to use live steam in sludge heating when it became necessary to expand the sludge digestion facilities at the plant.

Construction of a third battery of multi-stage sludge digestion tanks was commenced as a WPA project in the summer of 1940, but with difficulties attendant upon the current crisis in national affairs and the present emergency, the battery was not completed and placed into operation until March, 1942. By the time the tanks were completed, the remaining sludge digestion features at

*Associate Editor

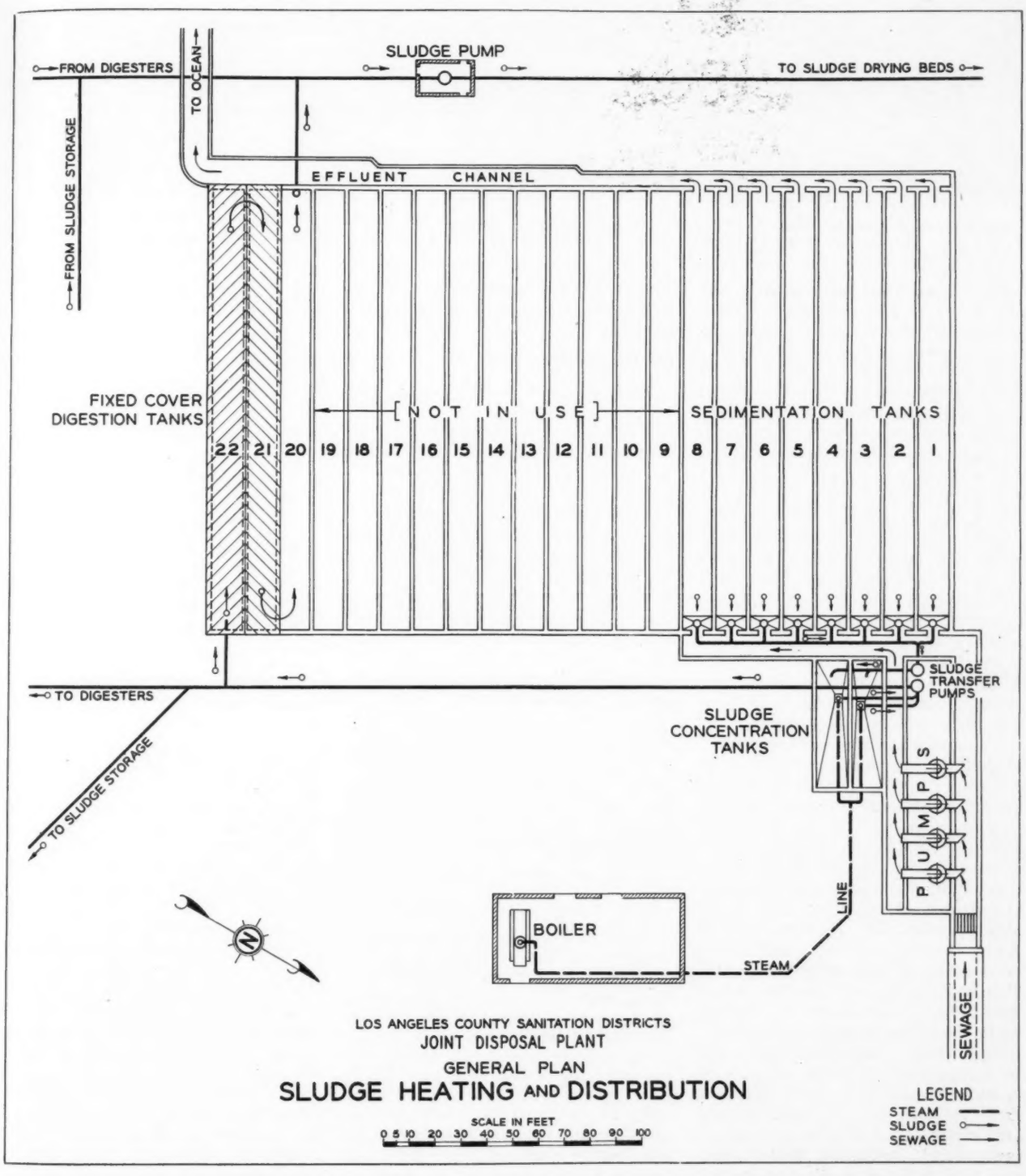


70-Hp. Boiler Used to Supply Steam for Direct Heating of Mixed Sludge Input to Coil-less Digesters—Formerly Sedimentation Tanks

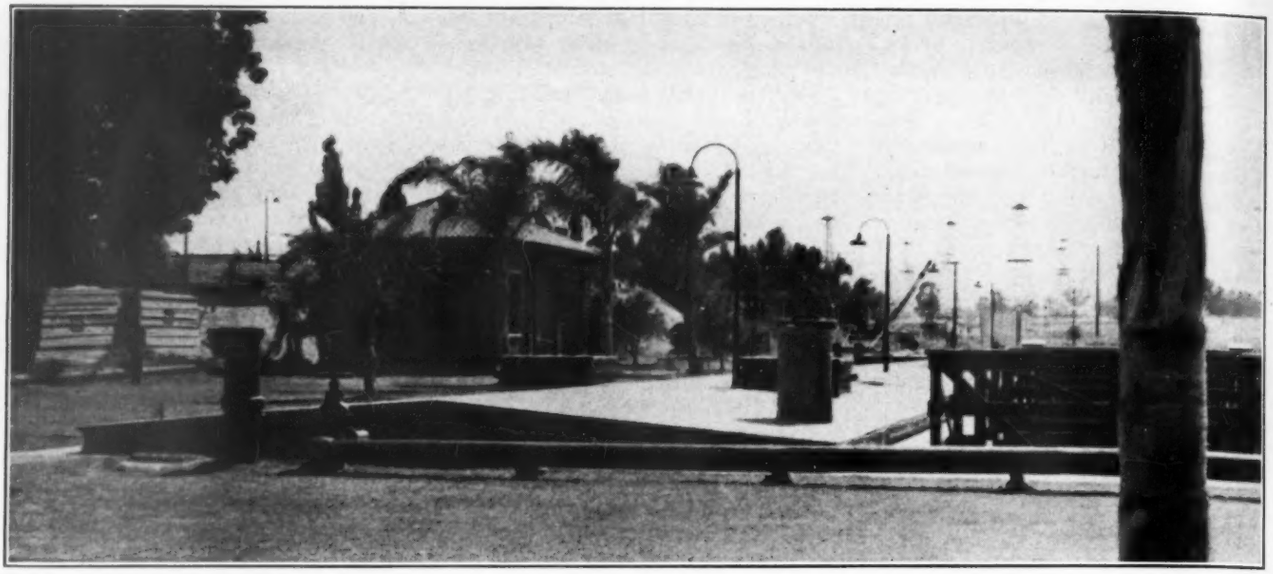
the plant had reached saturation and every spare tank in the area of any description was filled with digesting sludge. Unfortunately, however, only the two 1930 batteries could be heated, consequently sludge digestion in the remainder of the unused tanks and basins in and about the plant area was greatly retarded because of lack of temperature control.

With the advent of March the situation was acute, but by that time the new battery of sludge digestion tanks was completed, including the 70 hp. boiler installation (see picture) designed to utilize sludge gas for fuel and to provide steam for heating sludge at the suction pumps of the two raw sludge concentrating wells.

The picture changed immediately. Sludge in the temporary tanks, in which the temperatures approximated 70°, was recirculated through the crude sludge concentration tanks along with raw solids and raised to a temperature of 90 to 95° at the transfer pump suction, then returned to the tanks, or transferred to other digesting units. The newly completed



General Plan of Sludge Heating with Live Steam and It's Distribution—Los Angeles County Joint Disposal Plant



End View of Fixed Gas-Tight Cover of Timber and Roofing Construction Converting Unused Sedimentation Tanks 21 and 22 Into a Sludge Digestion Unit. Timber Railing is Around Tank 20—(See accompanying plan)

battery was filled with sludge and seed which had been raised to a temperature of 90° F. and which maintained temperatures of 85 to 90° without further heating until digested. A large partially digested sludge mass in the holding pit was warmed and construction immediately commenced upon covering certain unused sedimentation tanks in the plant with temporary gas tight covers of timber and roofing construction. These fixed covers converted these tanks into useful digestion units—a feature which could not have been accomplished otherwise without great cost for heating coils. One trio of these tanks, illustrated here, has been completed and is functioning with complete success.

The Districts' Joint Disposal Plant was originally constructed as an activated sludge sewage treatment works and functioned in that capacity from 1928 to 1938. Upon completion of the ocean outfall, the activated sludge features were removed from the plant and it was converted into a primary sedimentation works with separate sludge digestion. Looking to the day of an ocean outfall, the former aeration tanks (twenty-two in number) had been designed primarily for use as plain subsidence tanks, and eight of them were immediately equipped with sludge removal mechanisms. The fourteen remaining tanks will be equipped in a similar manner as increased flows at the works require their use, but in the meantime they are idle and it is a trio of these tanks—each 12½x12½ feet in section and 175 feet in length—which have been converted into sludge digestion units. Three more sets of tanks will be similarly equipped this summer.

Plant Practice

Present practice at the plant is to transfer raw sludge from eight sedimentation basins to two sludge concentration tanks. Sedimentation basins are 12½x12½ feet in section and 175 feet long. Sludge concentration tanks are of like cross section but are 50 feet in length and lie side by side, their long axes parallel. Each concentration tank is equipped to drain to a small bottom hopper from which the sludge transfer pump suction draws. As the concentration tanks are being filled with raw sludge, 20 per cent by volume of digested sludge is returned thereto for "seed." When the tanks have been filled with the mixture, the entire mass is transferred to the designated sludge digestion tank, and as the transfer pump starts, live steam is ejected into the tank hopper from which sludge is drawn.

Advantages of the System

The system has many advantages:

1. It is entirely flexible, permitting the control of sludge temperature in any receptacle which will hold sludge, whether it be an earthen pit, a lined retention chamber—covered or uncovered—an unused tank or basin, or a regulation sludge digestion unit.

2. The adjustment of sludge temperature is not at all dependent upon the temperature of the incoming sludge. The adjustment is made by either regulating the flow of steam at the pump suction or the speed of the transfer pump.

3. It eliminates entirely the use of heating coils with all of their attendant difficulties.

4. It permits a 10° F. rise in temperature in more than 100 gallons of wet sludge, with but one gallon of water applied as steam, thus less than 1 per cent is added to the sludge mass as water.

5. It admits of dosing warmed sludge into the warm sludge mass whereby the temperature of the digesting sludge is not disturbed or changed during the process of dosing.

6. The heating and transfer of sludge from the concentration tanks to the digestion tanks—or whatever structures in the area are being used for that purpose at the time, is accomplished in about four hours daily. The total amount of raw sludge transferred to digestion every day approximates 175,000 gallons, to which is added 45,000 gallons of seed before the sludge is warmed up. Said sludge usually drawn from the multi-stage digestion tanks—but occasionally from the sludge concentration pit—and the mixing of raw and seed sludges prior to transfer to a digestion chamber, results in a lessened disturbance of seed to raw sludge ratio in any of the tanks in which the mass is discharged.

The foregoing are about the main advantages of this new adventure. It has the disadvantage of using more water than the water circulation system, and it likewise does not take advantage of heat transferred

to the jacket water of sludge gas engines, although even this may eventually be possible when the new "Vapor-Phase" cooling system is perfected, wherein the circulating water is constantly maintained above the boiling point and live steam given off as the pressure is released in recirculation.

Question of Odors

Lest there be some misgivings about odors emanating from raw sludge heated to temperatures of from 85 to 95° F., it is worthy of note that the contents of the sludge concentration tanks have been raised to a temperature of 130° F. without any noticeable or distinguishable change in the odor of the contents, and since there has been some question regarding vapor-lock in a sludge pump when live steam is injected into the suction line within 20 feet or so of the pump itself, it may be stated that the experience at the District's disposal plant indicates that the sludge pumps operate as smoothly with the steam injected into the suction as without.

The steam boiler at the Sanitation District's disposal plant is operated at a pressure of 30 pounds per square inch. The only advantage in this over a much lower pressure is that the steam feed water pump will not operate at less than 30 pounds; otherwise the pressure would be maintained at below 15 pounds. Because of the latent heat factor in live steam, the gallons of sludge which may be heated by one gallon of water converted to steam at zero pressure is almost equal to the amount which may be converted at 125 pounds per square inch, the difference being in the ratio of approximately 110 to 114. This approximate computation is based upon the use of saturated steam and an assumed heat capacity of sludge of 1 B.t.u. per pound per degree Fahrenheit.

Use of Non-Critical Materials and Simplicity a Feature

The process is so easily installed, so cheaply operated, and so extremely flexible, and has proven so successful in operation at the plant described, that the information is passed on for the benefit of those who may encounter some of the difficulties herein enumerated with the present system of heat transmission. It also is detailed here to some extent to indicate that in this particular time of shortage of materials and restrictions upon the use of available materials by WPB and other Federal agencies, existing tanks or basins in or about the plant not otherwise in use may be covered with inexpensive tops of some sort comprised of materials which are not deemed critical at this time, and converted directly into controlled sludge digestion tanks for use during the emergency. The potentialities of the system become apparent when one visualizes its complete flexibility. The fact that it has no deleterious effect upon sludge digestion is a strong argument in its favor.

N.E.W.W.A. Names Brigham as Next President

Kennison New Vice-Pres.; Calderwood New Director

Harold Brigham

Don Calderwood

The Nominating Committee of the New England Water Works Assn. has announced the following slate as its choice of new executives to take office at the close of the annual meeting in September. Such nominations are tantamount to elections. The Nominating Committee's choices are:

For President (1 year term)—Harold L. Brigham, Supt., Water and Sewage Comm., Marlboro, Mass.

For Vice President (2 year term)—Karl R. Kennison, Ch. Engr., Metropolitan Distr. Water Supply Comm., Boston.

For Director (3 year term)—Donald C. Calderwood, Engr., Pennichuck Water Works, Nashua, N. H.

For Treasurer—Frank J. Gifford, Cambridge, Mass.

[*Note: The carry-over Vice-President is Horace L. Clark, Supt. of Water, Sanford, Me.]

*Inasmuch as each new Vice-President is elected for a two year term, the senior vice-president's name never appears on the slate of nominations, which means that temporarily he is apt to be in the category of the well known "Forgotten Man." For the benefit of those who may not remember, the Senior Vice-President of N. E. W. W. A. for 1943 has been added to the list of officers to be released by the Association. And we throw this out as a suggestion for future Nominating Committee reports. A more direct routing would, of course, be that of nominating the Junior Vice-President for a one year period only. If the committee was wise in a two year choice it could be just as wise in its choice of the same incumbent two years in succession.

It is noted that Frank Gifford, long Secretary of the Association, is to become Treasurer. This would signify that the Executive Committee of N. E. W. W. A. will be faced with the selection of a new Secretary after this year's annual meeting.

No Restriction on Lead

Judging from papers recently read at meetings, there seems to be an impression that lead is one of the scarce metals, the use of which is restricted by War Production Board. Although, as far as we are aware, lead has never been considered so scarce as to have to be denied the water works industry. However, the belief that it is seems to be gaining momentum as evidenced by the following statement recently made by the Lead Industries Association.

"The fourth provisional report on relative scarcity of certain materials issued July 2, 1942, by the Conservation and Substitution Branch of the War Production Board has dropped lead into Group III. Materials in this group are described as 'Materials that are available in significant quantities as substitutes for less available materials, and materials that are available in large amounts unless restrictions are imposed by labor, manufacturing, or transportation difficulties.'

"Thus water works now have at least one customary metal at their disposal which can be used for its regular applications as well as to conserve other more critical metals and many misunderstandings about the real lead supply situation will be cleared up."

Not only is lead not restricted for water works and sewerage use, it is not restricted for plumbing uses either.

CLEANING ENCRUSTED PIPE LINES AND VACUUM FILTERS

By Use of Inhibited Muriatic Acid

By K. L. MICK
Chief Chemist
MINNEAPOLIS-SAINT PAUL SANITARY DISTRICT
ST. PAUL, MINNESOTA

CONSIDERABLE muriatic or hydrochloric acid has been used in our plant for removing carbonate scale from pipe lines, filter cloths and vacuum filter parts. To minimize the acid attack on metal parts of the equipment and on pipe lines, it was deemed advisable to use an inhibitor with the acid. Certain protein materials such as bran, or organic amino compounds such as aniline oil (aminobenzene, $C_6H_5NH_2$) are capable of retarding the action of strong acids on metals by preventing or slowing down the evolution of hydrogen at the metal surface in the reaction—

$$Fe + 2HCl = FeCl_2 + H_2\uparrow \text{(gas)}$$

They are called inhibitors and are believed to function by raising the hydrogen overvoltage on the metal, i.e., they raise the potential required to force off the protective blanket of hydrogen as gas bubbles. Unless sufficient potential is available, the hydrogen will tend to accumulate on the metal surface and the reaction written above will slow down or stop, thus protecting the metal from further action of the acid. However, the corrosion inhibitor will not affect the action of acid on the carbonate scale which it is desired to remove, the reaction being—

$$CaCO_3 + 2HCl = CaCl_2 + CO_2\uparrow + H_2O$$

Twin-Cities Plant Practice

The acid used at this plant is commercial 18° Bé. muriatic acid (28 percent HCl), purchased in 125 pound carboys. Some laboratory tests were made to determine the proper proportion of aniline oil to acid. For these tests a number of 1x3 inch panels of 23 gauge mild steel were immersed in acid solutions of various strengths, 0.7 per cent HCl, 2 per cent, 5 per cent and 10 per cent. One of each of these acid solutions was left untreated with the aniline oil to serve as a control comparison, and aniline oil was then added in various dosages to each of the acid solutions. In evaluating the rates of acid corrosion of the steel, use was made of Speller's formula, which takes into account the loss in weight, the area exposed, and the time of exposure.

The Author

The results indicated that a 2 per cent aniline oil dosage (by weight of pure HCl) could be used with the weaker acid solutions, up through 5 per cent HCl, while stronger acid solutions should have a 3 or 4 per cent aniline oil dosage for maximum protection of metal parts.

With a 0.7 per cent HCl solution (which is the initial strength obtained in our plant when one carboy of commercial muriatic acid is added to about 600 gallons of water in the filter pan), a 2 per cent aniline oil dosage will cut the corrosiveness of the acid by 44 per cent, according to the laboratory tests. A 2 per cent aniline oil dosage in a 5 per cent HCl solution cuts the rate of corrosion nearly 97 per cent, while in a 10 per cent HCl solution a 4 per cent aniline oil dosage was required to reduce the rate of corrosion by 69 per cent.

Added to a one-carboy acid bath for a filter, 300 ml. of aniline oil will reduce the corrosiveness of the acid about 44 per cent for the small cost of 25 cents. For protection of the screen and the thin nailheads in the wood splines, this added precaution would seem justified even though the rate of corrosion with an acid solution of this strength is apparently quite low.

The application of the acid bath is very simple. Sufficient water is run into the filter pan to just submerge a portion of the drum (about 600 gallons at this plant). The aniline oil treated carboy of acid is then syphoned into the water, with the filter drum and agitator in operation. After two to three hours the acid is usually pretty well spent (a titration test will tell) and the solution is then drained off and the filter washed with the water sprays. If the filter and cloth are badly scaled, more than one carboy of acid may be needed.

The filters at this plant are now given an acid bath after about 350 hours of cloth life, with the cloth and screen left in place. This treatment increases the economical life of the filter cloth to 500 or 600 hours and at the same time removes the scale from the screen and splines.

To clean the pipe lines of carbonate scale, the inhibited acid bath is recirculated through the lines. The scale is disintegrated and sloughs off.

[Ed. Note—It is quite evident that the use of inhibited acid applies in water purification plants as well as sewage plants—also for cleaning small pipe lines of iron scale.]

N. Y. SEWAGE WORKS ASSOCIATION FEATURES WARTIME PROBLEMS AT ALBANY MEETING

By GEORGE E. SYMONS*
BUFFALO, N. Y.

We are indebted to Dr. Symons for having so promptly reported the June meeting of the N. Y. Sewage Works Association.

Although this report was received in time for inclusion in our June issue, the increased volume of reference type of articles, planned for in advance for that issue which features Reference and Data material, necessitated the delayed printing of this report.

As a matter of fact we temporarily overlooked Dr. Symons' p e n c h a n t for doing "today's things today" and failed to indicate to him that in all likelihood the report could not be included in our June issue. We regret the necessity of delayed publication, and will have to lean on the old axiom of "B e t t e r late than never!"—if such an axiom longer holds water in these times.

AS WITH many recent meetings, the keynote of this one was defense and the effect of war on sewage and sewage disposal plant operations. That the war has affected the Association as well as sewage plant operations was evidenced in several ways. The attendance at the meeting was only seventy-five, the smallest ever recorded, and the Secretary reported that for the first time in the history of the Association there had appeared a sag in the growth curve. The membership is lower now than at the same time last year. (Part of this decrease may be due to men going into service and part to the increase in dues to $6.00 per year.)

*Chief Chemist, Buffalo Sewer Authority.

Changes in personnel of the Association's advisory board have likewise been brought about by the war. Mr. Lawrence Luther, of Freeport, Long Island, resigned as a member of the Executive Committee and Vice-President of the Association to enter the services of the Red Cross Corps. "Larry" Luther, who is also secretary of the Long Island Section, is now in training as a Field Director at Washington. The Executive Board appointed Mr. Edwin C. McKeeman, Chief Operator of the Freeport, Long Island, plant to fill the unexpired term of Mr. Luther.

The President
C. R. Velzy
Greeley & Hansen Engrs.
Chicago
(Former supt. of Buffalo plant)

New Director
C. Geo. Andersen
Supt. of Sewerage
Rockville Center, L. I.
(Elected to the Federation Board)

Other business of the Executive Committee included the election of Mr. C. George Andersen, of Rockville Centre, a past president of the Association, to represent the N. Y. S. S. W. A. on the Board of Directors of the Federation of Sewage Works Associations.

The opening session featured two papers on the subject of wartime effects on public works.

"Changes in Public Works Administration Due to War Time," by Newell L. Nussbaumer, Commissioner of Public Works, of Buffalo, N. Y.

Introducing the subject by outlining the work of the Public Works Division of Buffalo, Mr. Nussbaumer went on to discuss the various additional duties, expenses and difficulties imposed upon a Public Works Department by virtue of the war. Among these additional duties have been the creation of a City Civilian Defense Organization, the protection of utilities services and structures, setting up mutual aid with suburban communities, and establishing schools for teaching reserve technical staffs and volunteers.

Additional expenses incurred includes such items as purchasing special equipment and materials for the defense organization, employing additional personnel and guards for vital utilities, increases in telephone costs. Interesting is the fact that the salvage program, wherein the public has been saving paper, has reduced the amount of burnables reaching the garbage incinerators, thereby requiring the purchase of coal, and remarked Mr. Nussbaumer, "both coal and gasoline have increased in price to further add to the expenses of the department." In the meantime, the amount of water pumped has increased, although the railroads are using less water.

Construction difficulties caused by war conditions are brought about by priority orders and "freeze" orders particularly in reference to asphalt

(1) State Dept. of Health Laboratory Buildings. (2) Henry Rath, Chief Operator, Talman's Island Plant, New York City. (3) Lieut. A. J. Krell, Sanitary Corps, Pine Camp, N. Y. (4) Jas. M. Brown, Operator, Lederle Labs. Plant, Pearl River, N. Y. (5) In the library of the State Laboratories, Dr. Harris speaking.

for paving. Lack of asphalt has, in turn, hampered the program of removal of abandoned street car tracks for scrap. Further problems of construction brought on by present conditions have included alterations to the airport for military use and the retention of salvage from demolished buildings for future repair and maintenance.

Building codes have been altered in order that previously condemned buildings can be used for storage purposes by making a minimum of repairs. In some instances, substitution of items has been necessary in construction; for example, transite and concrete for iron, and substitutes for lead and copper.

Continuing, Mr. Nussbaumer said, "It has been found advisable to decentralize the central storehouse of the water department and central garage facilities, and extend the collection days for garbage and ash. Further observable effects of military and defense operations are obvious in the use of a city auditorium to house troops and the administration of the airport by the Army. Twenty-four hour operation in defense plants has increased the amount of all-night parking, which in turn has affected the program of street cleaning and snow removal."

Not only operations, but also staff personnel has been affected. Young men have been drafted and many trained technical men have left to take more lucrative jobs in defense plants. In some cases pay raises have been required to keep key-men and the more essential employees from leaving, and this too has increased operating expenses. In other cases men have been loaned to defense industries or Army service, and in still other cases forced layoffs of whole departments have been necessary because of curtailment of operation.

This problem of personnel is aggravated by the fact that replacements are frequently of inferior grade or advanced age resulting in increased sick leave, substitute labor and time off. In order to prevent the "freezing" of these substitute employees in the Civil Service, Mr. Nussbaumer said that an attempt is being made to have them classified as temporary for the duration of the war. As to manpower available, Mr. Nussbaumer pointed out that whereas in December, 1935, there were 35,000 men on the W. P. A. roll in Buffalo, there are now only 415.

In closing, Mr. Nussbaumer suggested that it is necessary to forecast a post-war pattern in the municipality as to housing and industry, and to correlate present construction to future program. "Engineering departments should design projects and prepare plans now for post-war conditions and prepare a definite program for an orderly sequence of construction."

Glenn Pinkney
Supt. of Sewerage
Webster, N. Y.
(Awarded plant improvement prize)

N. L. Nussbaumer
Director, Pub. Wks.
Buffalo, N. Y.
(His problems multiplied by war)

Following Mr. Nussbaumer's paper, there was considerable discussion of the subject of temporary civil service employees and problems, leaves of absence for men entering the service, and the matter of tin can and paper salvage. Mr. Morris Cohn, of Schenectady, told how the materials received at the incinerator reflected public opinion on the matter of salvage. Speaking of the salvage of tin cans in Schenectady, Mr. Cohn said, "the two greatest needs to obtain good clean cans is sufficient publicity and a good can opener."

"Civilian Defense Measures in Public Works, Borough of Queens, New York City," by William Raisch, Consulting Engineer, Borough of Queens, and Borough Chief, Public Works Emergency Division, Citizens Corps, New York.

Mr. Raisch, too, introduced his subject by discussing the problems of a public works official with particular reference to civil service and the necessity for laying off young men, not old, because of the decrease in municipal work. Like Buffalo, he has experienced the difficulty of removing tracks because of lack of asphalt replacement, but stated that late information had indicated the probability of a waiver on asphalt for that purpose.

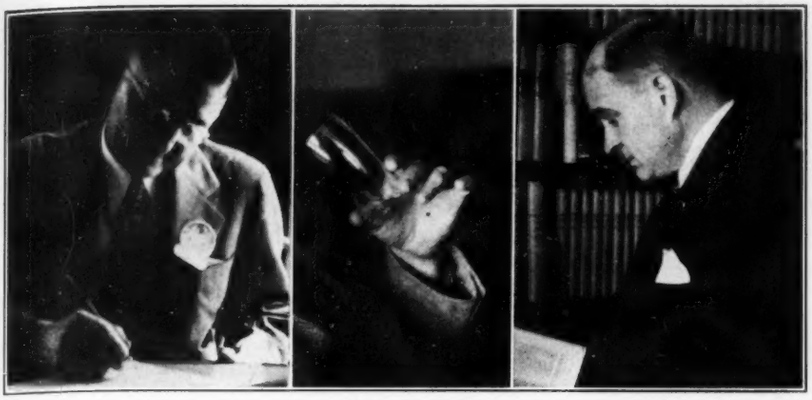
Mr. Raisch said they incinerated very little material and that the wastes were used for sanitary land fill. Salvage is picked up separately on special days, but it has been dumped on the common dump and later "picked" by contractors.

"The Borough of Queens," said Mr. Raisch, "contains 118 square miles with 2,300 miles of streets and 1,150 miles of sewers, and with a population of 1,300,000, is a city sixth in size in the United States. It holds many military objectives and because there is much wooden construction it presents a real problem in the event of bomb damage."

The defense program in the Borough of Queens includes the usual control room, with the Department of Public Works represented. In the case of damage, Incident Officers report to the Public Works staff and these engineers coordinate the survey of incidents and decide where apparatus goes to work. Maps showing the location of all apparatus are kept up to the minute. There are twenty-three batteries of equipment, each consisting of six trucks and twenty men, which may be used for the repair of all types of service. Included are demolition trucks, 2½ ton trucks for tools, an air compressor, a pump truck, a rigging material truck, and a general utility truck. All personnel manning these batteries live near the point where their particular truck is garaged.

In addition to these batteries there are 100 units of special squads consisting of two to six men for emergency repair to gas, electric, water, sewer, and phone utilities. Park and sanitation equipment is also available. Especially significant was Mr. Raisch's revelation that contractors have been organized to assist in the work along with members of the local unions and local plumbing contractors. Over a thousand pieces of

(1) A. F. Dappert presenting cup to N. M. Fuller, supt. of water and sewerage, and A. H. Mann, plant operator, Olean, N. Y. (award for best plant operating records). (2) Winner of prize for outstanding example of plant beautification—Frank Hall, plant supt., Mineola, L. I. (3) At the speaker's table Col. Hardenberg (next to be introduced by President Velzy, nearest to camera) looking over his notes on the Colonel.



(1) *"G. E.'s" Crawford signs the register at the State Laboratories.* (2) *In room 660 —just a bit of proof that Hitler's subs haven't stopped a wee bit of Scotch from coming through for thirsty sewage operators.* (3) *Bill Raisch doing a little perusing in the Health Dept. Library.*

apparatus are now available, averaging nine pieces per square mile.

Sewer repairs are made by special crews who have plans of the sewers and work under the direction of engineers. Volunteers not trained in this profession have been found to be detrimental rather than helpful. Pumping stations are underground and are manned by continuous crews. No special precautions have been taken at sewage plants, for it is believed more important to remove sewage from local spots.

Mr. Raisch stated that he had found it advisable to hold many practice runs for the crews and to require them to spend considerable time in special schooling. All of this work has been carried on without financial assistance from the Federal Government although the W. P. A. have helped in some minor details.

During the discussion of Mr. Raisch's paper it was brought out that police cooperation was essential and that there was a need for standard insignia for the trucks in order that air raid wardens would allow them to travel. Since these batteries travel *after* the raid has started (and most probably is over), it is not necessary for them to dim their lights even during a blackout.

Some of the problems incident to the program include the handling of requests for time off by city employees after they have spent an evening on the volunteer preparational work. Union men have asked for insurance which, to date, cannot be furnished, and others have desired to volunteer because of their desire to obtain an "X" gasoline rationing card.

In summing up the discussion of Mr. Raisch's paper, A. F. Dappert of the State Department of Health pointed out that there had been three stages in the program: first, careful preliminary planning; second, organization and developing a system; and third, training and drilling of personnel.

Olean Operators Win Award

At lunch, A. F. Dappert, Chairman of the Rating Award Committee, presented the award for the best report on plant operation for the year 1941 to Messrs. N. M. Fuller, C. A. Hardy and A. H. Mann, respectively Superintendent, Chief Operator, and Operator of the Olean, N. Y. Treatment Works. In accepting the award, Mr. Fuller stated that it had a value not only as a reward for effort, but it also focussed local attention on the importance of sewage treatment, as well as educating the operator in the need for good reports.

Arthur S. Bedell, President of the Federation of Sewage Works Associations, spoke briefly on the committees of the Federation, mentioning that several are similar to those of the N. Y. Association, for example: An award committee, an operating report committee, a committee on publicity and public relations, a committee on operators' qualifications, as well as a committee on civilian defense and a committee on post-war planning.

Col. Hardenbergh Explains the Sanitary Corps' Duties

The luncheon guest speaker was Col. W. A. Hardenbergh, Sanitary Corps, U. S. Army, Washington, D. C., who gave a resume of some of the problems of the Sanitary Corps of the U. S. Army. While the operation of some 200 treatment plants is delegated to the Engineer Corps, the Medical (Sanitary) Corps is charged with the survey of sites, inspection of plants and supervision of laboratory analyses.

Most of the difficulties in plant operation have occurred from the unpredictable increase in loads, otherwise good results have been obtained in all types of plants, including plain sedimentation, trickling filter, high capacity filters and activated sludge plants.

Col. Hardenbergh stated that for camp plants a general design basis is 70 gallons per capita per day; for camps of 10,000 a factor of two is used; for a camp of 50,000 the factor is one; and intermediate factors are used for camps between those sizes.

In addition to control of water supply, water treatment and sewage disposal, an important service of the Medical (Sanitary) Corps includes mosquito control. As a result of this work, the malaria rate is now one-quarter of what it was last year and is far below the incidence of 1917-18. In 1942 the work will be carried on in 250 places, nearly all of which are in cantonments. Because of the size of the cantonments of the present war, it is found that malaria control outside of these areas is not essential. This control has included the spraying of No. 2 diesel oil and the construction of 541 miles of ditches. At least twice that many miles of ditching will be dug in 1942.

In discussing some of the problems inherent in expeditionary forces Col. Hardenbergh mentioned the possibility of lead in water obtained from run-offs of airplane runways. A kit is now being prepared for the individual soldier, making it possible for him to chlorinate a supply of water, test with ortho-tolidine paper, and dechlorinate if necessary. Physical problems of oversea armies are not only the concern of the Colonel; there is a need for personnel enlargement which is being attempted on a voluntary basis. Five hundred sanitary engineers, 125 entomologists, and 800 assorted medical bacteriologists, biologists and sanitary chemists are needed.

The afternoon session consisted of an inspection trip to the New York State Department of Health Laboratories in Albany. After a welcome by Dr. Mary B. Kirkbride, Associate Director, the work of the various departments of the laboratory was described by the persons in charge. Following this, the guests were conducted on a tour of the laboratories. The evening's entertainment was a display of General Electric's "House of Magic."

Hall Takes Plant Beautification Prize Back to Mineola

At the famous N. Y. Association "Sunrise Breakfast," the announcements of the awards for the plant beautification contest and plant im-

provement contests were made. Frank Hall, Superintendent of the Mineola, L. I., plant, was awarded first prize for the beautification of his plant; tied for second place were Thomas A. Vickers, of Comstock, N. Y., and William C. Hamm, veteran superintendent at Port Washington, L. I.

Webster's Pickney Wins Plant Improvement Award

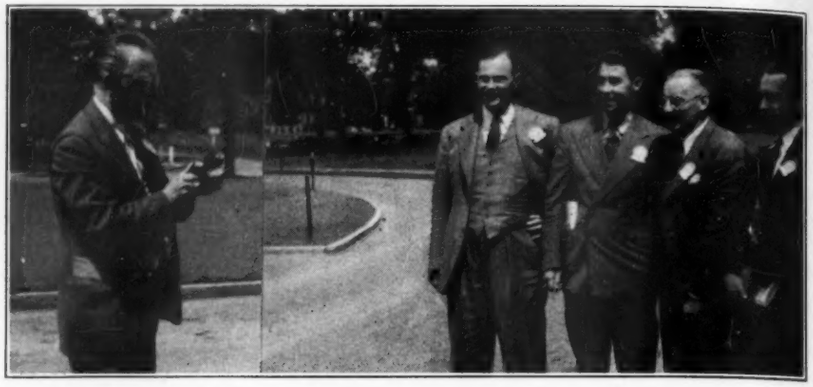
Prizes in the plant improvement contest went to the following: Glenn Pickney of Webster, Arnold Hale of Brighton, E. A. Marshall of Geneva, and Clarence Kellogg of Mt. Morris. This latter contest was for the best idea for the improvement of operation of a sewage treatment plant, whereas the plant beautification contest consisted of landscape pictures "before and after."

War Time Problems in Sewage Treatment—(Round Table Leader, Morris Cohn.) In introducing the subject Mr. Cohn said that sewage reflected the life of the community, and listed many of the changes which had or were occurring in sewage plant operation due to war time conditions. "The sewage operator," said Mr. Cohn, "is the man behind the man behind the man behind the gun." (*Ed. Note*—We do not know exactly how this works out, but we take it that sewage treatment has something to do with a "behind.")

Dr. George E. Symons, Chief Chemist, Buffalo Sewer Authority, Buffalo, N. Y., outlined some of the general effects of totalitarian warfare on sewerage and sewage disposal utilities. Discussing the possibilities of gun fire, bomb blasts, fire bombs and sabotage, Dr. Symons mentioned the possible dislocation of service, increased load on sewage plant, and disruption or loss of sanitary facilities.

"Among the general protective measures which can be used to combat these damages are the provision of fences and guards at plants, provision of floodlighting, provision of extra repair parts and trained extra repair crews, investigation of and identification of personnel and elimination of visitors."

"Results of damage may include flooding of cellars, interruption of toilet facilities, contamination of water supplies, and the escape of chlorine gas if chlorinating facilities are demolished." In discussing what can be done to offset these effects, Dr. Symons mentioned the work of repair crews, protection against chlorine tank damage, and health precautions necessary in the clean-up of flooded cellars. As to individual problems of the City of Buffalo, Dr. Symons told of changes in industrial wastes, the necessity for stocking smaller quantities of chlorine, and the visitor problem at the plant, including men who desired access to the grounds in order to dip minnows for bait.



Behind the "picture box"—Morris Cohn, shooting for "municipal sanitation." And the victims—Highberger, Winfield, McWardle, Sanderson.

W. Fred Welsch, Senior Engineer, Division of Sanitation and Water Supply, Nassau County, told of the development of the Mutual Aid Plan in Nassau County and the need for thoroughly trained men inasmuch as untrained men often cause more damage than they do good. As an example, of the application of some of the precautions suggested by Dr. Symons, Mr. Welsch told of the work of Herbert O. Johnson, of Belgrave, where guards, fencing and floodlighting are employed.

Major J. A. Brewster of the U. S. Public Health Service, in charge of civilian defense in Zones I and II, emphasized that civilian defense is concerned with the restoration of utilities, whereas the Army Intelligence is concerned with the prevention of sabotage. "From the standpoint of the Army," said Major Brewster, "the important thing is to maintain water supply for industry. Whereas sabotage is not prevalent now, it may soon be when new organizations for subversive activity have been effected and when our enemies begin to lose." "Not only may we expect sabotage," continued the Major, "but we may expect token bombing such as given to Tokyo by General Doolittle."

Stating that there was need for auxiliary repair crews, trained men, and a full inventory of supplies, Major Brewster emphasized that there must be coordination of all facilities at the municipal level. "The shot in the arm of Pearl Harbor is wearing off and defense efforts are bogging down with smug complacency," warned the Major, "and experimental drills, schools, and general effort must be continued if we are to succeed in the purpose of these civilian defense organizations."

Earl Devendorf, Assistant Director, Division of Sanitation of the N. Y. Dept. of Health, asked the meeting to go on record with a request that the President of the Federation of Sewage Works Association make contact with the proper officials in Washington to establish a list of key positions in sewage plant operations, from which the incumbent employees would not be called either for military or drafted occupational service. This action on the part of the Federation will parallel that of the American Water Works Association. The meeting went on record as favoring such action by the Federation and the resolution at the end of this report was unanimously voted.

A. F. Dappert, Principal Sanitary Engineer, Division of Sanitation, N. Y. State Dept. of Health, gave the concluding paper on the Round Table discussion, speaking on the Mutual Aid Plan.

Mr. Dappert mentioned the need for sewer departments to prepare for emergencies, even in small cities, which might not generally be considered target areas. Explaining how the personnel and organization of the Department of Health were an integral part of the Mutual Aid Plan, Mr. Dappert told how the preliminary work consisted of locating inventory of materials and establishing interconnections between available supplies.

"Next step is the training of men to teach volunteer crews on how to perform the work," said Mr. Dappert, and continued, "the training program will consist of a three-day school conducted by the Department of Health. To this school will be invited not only water plant operators, but also sewage plant operators. The

school will explain the program of mutual aid, explain the lessons, and explain teaching methods, so that the operators may return to their cities and instruct their volunteer crews.

Resolution Pertaining to Drafting of Essential Operating Personnel

In the closing hour of the meeting the following resolution was offered and unanimously voted.

"Whereas, a balanced national program of defense and war requires not only an active military organization but a strong and dependable system of public health conservation at home, and

"Whereas, the continuation of effective sewerage and sewage treatment facilities is an essential element in the preservation of the high and decent standards of living for which we are fighting and through the preservation of the public health serves to protect the industrial strength which is so vital to our fighting forces;

"Now, therefore, be it resolved, that the New York State Sewage Works Association assembled at its Spring meeting in Albany on June 6, 1942, appeals to the Federation of Sewage Works Associations to make proper contact with the Selective Service Organization and the U. S. Public Health Service, and to urge the safeguarding of public health by preventing the depletion of that personnel which is vital, essential and irreplaceable in municipal, national and institutional sewerage and sewage treatment systems, and

"Further, be it resolved, that the Federation be urged to offer every assistance which the profession can render in the war effort and the vital defense of the home front."

H. M. Lofton Dies at Age of 74

Herbert Merrill Lofton, retired general manager and treasurer of the Columbian Iron Works, in Chattanooga, Tenn., passed away on June 17 at the age of 74.

Born in Coweta, Ga., Feb. 14, 1868, he received his engineering training at Pratt Institute in Brooklyn, N. Y., and returned south to become superintendent of water works for Savannah, Ga. In 1908 he went to Chattanooga and became associated with the Columbian Iron Works in the manufacture of water works valves, hydrants and other equipment. In his lifetime he had been granted 55 patents.

In the first World War Mr. Lofton converted his plant into a shell producing plant, the efficiency of which won for him an U. S. Army citation and resulted in his being called to Washington and given the assignment of organizing other companies in the South for the production of arms.

Mr. Lofton was one of the oldest living members of A. W. W. A., having joined 47 years ago in May, 1895. He was made an Honorary Member of the Association in 1940.

He is survived by his widow, a daughter, and a son, Merrill C. Lofton, of Chattanooga.

Emergency Water Service Training Schools

Emergency Water Service Training Schools of three-day duration are being held in five of New York's larger cities for the benefit of water works operators and others interested in maintaining water supply during the emergency. These three-day schools are being held at the following places:

New York City, July 13-15.
Albany, July 16-18.
Syracuse, July 20-22.
Elmira, July 23-25.
Buffalo, July 29-31.

The N. Y. Section of A. W. W. A. is acting as a cooperating agency in connection with these Emergency Training Schools.

"Bob" Allton of Columbus Passes

Robert A. Allton, former superintendent of the Columbus, Ohio, Sewage Treatment Plant, passed away at his home in Hudson, Ohio, on June 25. He was 50 years old.

Robert A. Allton

"Bob" Allton was a native of Nashua, N. H., and a civil engineering graduate of the Mass. Inst. of Technology. He had assisted in the design and operation of a number of sewage treatment plants and prior to coming to Columbus in 1928 to take charge of the design and construction of the new activated-sludge plant, was connected with the Dept. of Sewerage of Akron for four years.

In the design of the Columbus plant he introduced many innovations and was awarded the Rudolf Herring Medal of the Am. Soc. of Civil Engineers in 1935 for his paper describing the new Columbus Sewage Treatment Plant.

Until his retirement last December because of ill health, "Bob" Allton was amongst those very few plant managers who designed and built the plant he operated. One of his most difficult jobs was that of developing a system of sewer rents and a rate structure for sewer service charges in Columbus. Because of this experience he was invited to speak before several associations and his valuable articles on developing a a system of sewer rental charges appeared in this magazine.

Dan S. McAfee Elected President of Manufacturers Association

McGinnis New Vice-President.

Dan. S. McAfee

C. A. McGinnis

The Board of Governors of the Water and Sewage Works Manufacturers Association at its meeting held June 23 in Chicago elected as the new president of the Association, Dan S. McAfee, Vice-President and General Sales Manager of The Dorr Co.

To the office of vice-president was elected Chas. A. McGinnis, who heads the Transite Pipe Department of Johns-Manville Co.

The new executives take office on November 1, 1942, Mr. McAfee being vice-president of the Association, and Mr. McGinnis chairman of the Executive Committee of the Water Works Division of the Association.

The president-elect is a native of Cleveland, Ohio, and graduate of Ohio State University. In 1916 he joined the Dorr Co. as sales engineer, becoming manager of the company's Development Department in 1920. In 1921 a Sanitary Engineering Division was established and Mr. McAfee became its first manager. In 1925 he became General Sales Manager and was elected vice-president of Dorr Co. in 1929.

"Industrial Waste Treatment Practice"

A New 389 Page Text by E. F. Eldridge, Michigan Engineering Experiment Station, Published by the McGraw-Hill Book Co.

Reviewed by
L. F. WARRICK*
STATE SANITARY ENGINEER
OF WISCONSIN

POLLUTION of waterways by sewage and industrial wastes, with attendant demands for corrective action, has brought a challenge to the sanitary, chemical and public health engineers in this country and abroad. Technical questions need to be answered before regulatory measures can be properly effected. The challenge is being met, with substantial progress already in evidence. Principles and practices in treatment of domestic sewage have been made known and standardized in considerable degree. Ingenuity and resourcefulness have been increasingly demonstrated in finding out ways and means for effectively and economically utilizing or treating and disposing of industrial wastes.

Excellent textbooks or manuals on sewage works design, construction, operation and maintenance have been published. Very few of the authors, however, have attempted to cover in any great detail the methods for dealing with industrial waste. Much information has been set forth in technical publications, bulletins of educational institutions, and reports of health departments and other agencies, but the time had arrived by the start of this decade for the appearance of a comprehensive treatise bringing together existing knowledge on the subject in a usable reference book. When one considers the highly diversified nature of manufacturing processes and resulting pollutional wastes, the task involved is appreciated. That the task has been ably done will be evident to the reader of "Industrial Waste Treatment Practice," by E. F. Eldridge.

Well qulaified, the author accomplishes his aim in presenting a practical treatise on the subject, covering clearly and concisely a broad field. The information presented will undoubtedly prove useful to sanitary and chemical engineers, students and others, as well as industrialists confronted with problems of trade waste disposal.

Development initially of sufficient background on the nature and history of pollution, the growing public interest in clean lakes and streams, and the magnitude and diversity of pollutional waste treatment problems is essential in any book of this kind. Terms peculiar to the subject and of a technical nature must be defined in a readily understandable manner. This is accomplished effectively in the introduction and first two chapters. Stream pollution is discussed under the headings of classification of industrial wastes, volume determinations, testing wastes for composition and predominating characteristics. Before proceeding with the main theme, the author presents a suitably illustrated section on standard treatment methods in sewage works practice, describing in adequate detail the principal structures and equipment of treatment works.

Facts regarding manufacturing processes, for the most part shown diagrammatically, bringing out points of origin of wastes and their nature, are presented for beet sugar, milk processing, canning, tanning, pulp and paper, textile, meat packing and slaughtering, laundry, metal, gas and coke, fermentation, and oil processing and refining industries. The importance of starting at the source of the wastes, reducing them to a minimum by utilization where practical, through use of improved equipment and operating methods, is brought out. Even though a waste reclaiming procedure may not pay its upkeep, it may be regarded as a relatively cheap method of treatment and disposal. Reduction of the wastes at the source failing to take care of the pollution problem, practical and economical treatment and disposal methods need to be employed. It is set forth that "one of the prime considerations in this discussion must be the ability of the industry, from the standpoint of both economy and operation, to apply the methods suggested."

Regarding the methods that have been developed for re-use or treatment and disposal of the wastes, a critical review is provided covering the application of various principles and devices that have been employed to date. Effects on the manufactured product, due to the re-use of wastes, are considered. Adaptability of different kinds of waste to physical, chemical and biological methods of treatment is interestingly covered, with sufficient accompanying data to bring out pertinent points. Those procedures that have been most thoroughly demonstrated or are particularly recommended for consideration are described in adequate detail. Flow diagrams, drawings of treatment systems and pictures of typical installations help the text materially. Also, design data is included.

Disposal of industrial wastes, with and without pretreatment, along with domestic sewage in our municipalities, is reviewed with suitable care. This is a more or less controversial matter and no common formula will provide the answer in all cases. The recognized difficulties and other facts of importance are outlined as they apply to wastes from the previously mentioned industries, when disposal with municipal sewage is undertaken.

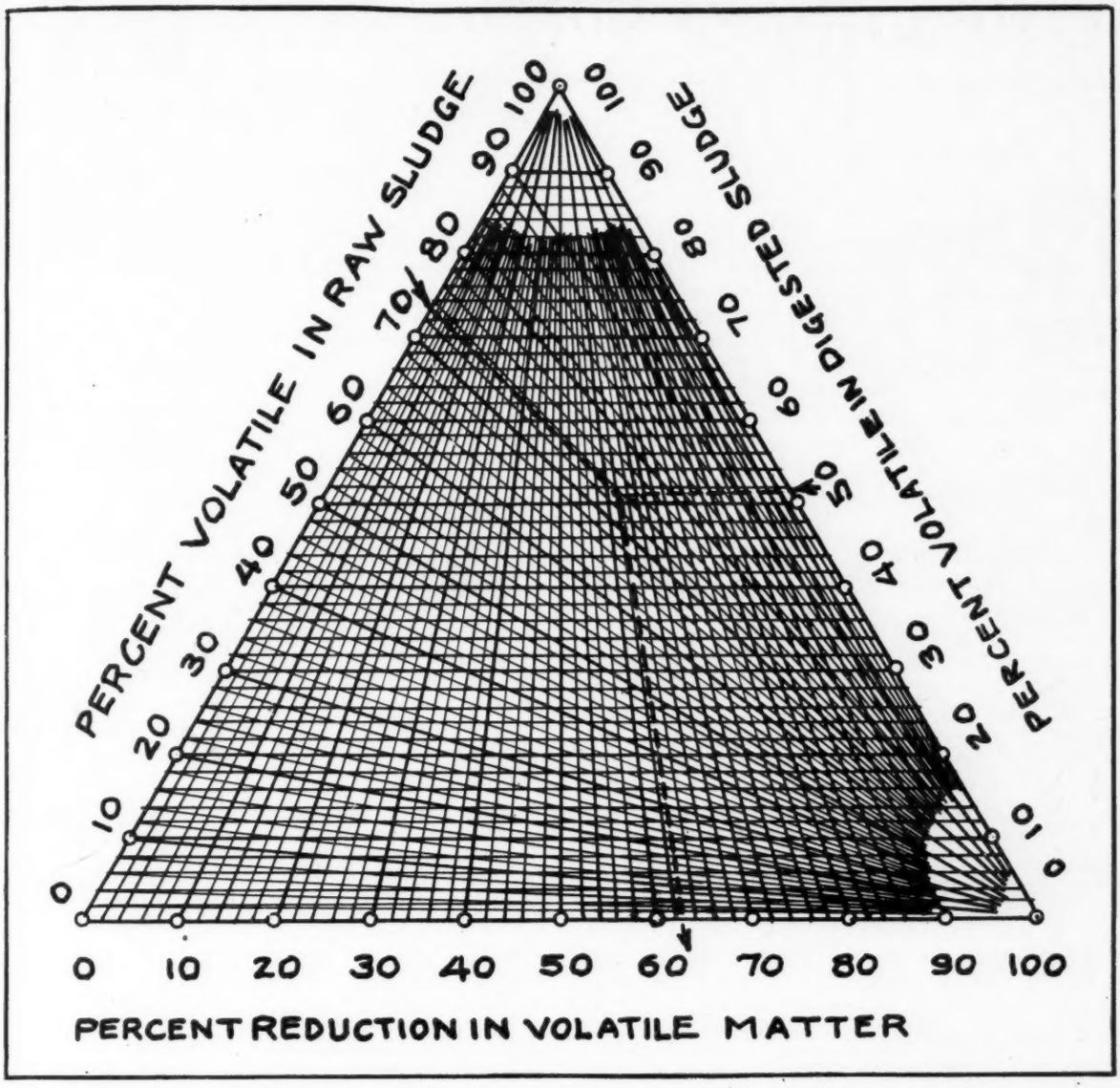
The book concludes with a chapter on methods of analysis for industrial wastes. Care in collection of wastes to secure representative samples is emphasized. Automatic samplers are described along with common pitfalls to be avoided in getting at a true estimate of waste and pollution conditions. The laboratory technique is outlined for determining suspended solids, biochemical oxygen demand, dissolved oxygen, acidity, alkalinity, chlorine demand, cyanides, phenol, fats (grease), fiber (paper mill wastes) and oil (quantitative). Calculation procedures for common methods of expression of results are given. Appended are the more frequently used formulas and conversion factors.

This treatise can be highly recommended for those having occasion to study industrial waste disposal problems. Your reviewer is of the opinion that the author has made a valuable contribution to the advancement of knowledge in this field and that the information compiled in this book will serve a highly useful purpose.

*Wisc. State Board of Health, Madison, Wis.

A USEFUL VOLATILES CHART

Contributed by FRED H. BURLEY, Supervisor
Sewage Treatment Plant
DETROIT, MICH.


PERCENT VOLATILE IN RAW SLUDGE
PERCENT VOLATILE IN DIGESTED SLUDGE
0 10 20 30 40 50 60 70 80 90 100
PERCENT REDUCTION IN VOLATILE MATTER

IT IS generally conceded that an excellent index to effective sludge digestion and efficiency of digester performance is the degree of conversion noted of the volatile matter in the sludge passing through the digesters. The degree of conversion is best expressed as per cent reduction of volatiles entering in the form of raw solids.

Volatile matter converted during anaerobic digestion is either evolved as gases or remains in the mother liquor (supernatant) as soluble organic or mineralized substances. The amount of gas produced is variously estimated at from 16 to 20 cu. ft. per pound of volatile matter converted.

The writer has found frequent computations of per cent reduction of volatiles on this basis to be a valuable check on digester efficiency, particularly so when considering the average figures for volatiles in the raw and digested products on the dry basis, from which the true reduction can be computed according to the following example.

Assume:

	Volatiles	Fixed
Raw sludge	73.5%	26.5%
Digested	51.2%	48.8%

Since in the raw sludge there was 73.5 lbs. of volatile matter for every 26.5 lbs. of fixed solids, there was originally present in the raw sludge

$$\frac{48.8}{26.5} \times 73.5 = 135.4 \text{ lbs. of volatile}$$

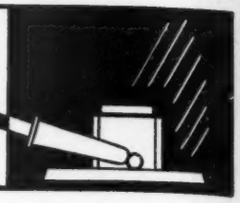
matter for every 48.8 lbs. of fixed solids. Therefore, the actual reduction is $135.4 - 51.2 = 84.2$ lbs. of volatile for every 135.4 lbs. entering as raw sludge. The reduction on a per cent basis is, therefore,

$$\frac{84.2}{135.4} \times 100 = 62.2 \text{ per cent.}$$

As a time-saver the accompanying chart was developed. It is simple to use. The arrows and dashed lines indicate the manner in which the per cent volatile in the raw and digested sludge (taking the above example) is located on two sides of the chart and the lines followed toward the opposite apex and parallel to the base, respectively, to their intersection. The line projected from this intersection to the base reveals the percentage reduction in volatile matter.

WATER WORKS & SEWERAGE, July, 1942

The Editor's Comments



Let's Play the Game!

LEADING water works managers of this country have gotten the water works industry of America on the well known spot with the War Production Board. This much was very apparent as can be read between the lines in the recounting of the priorities situation and the status of the water supply industry by J. A. Krug of W. P. B. in his address to the A. W. W. A. during its Conference on Wartime Water Works Problems in Chicago.

Printed in this issue, at the expense of postponing the appearance of a report covering the very worth while and successful Chicago Conference, is Mr. Krug's address on "War Production Policies and Water Works Practices" in full. Following it are questions asked W. P. B.'s Chief of the Power Branch from the floor and the clean cut answers. If you haven't already done so, drop this long enough to read thoroughly Mr. Krug's review of the priorities situation and comments on water works practices which are cause for concern if the situation revealed by the records is not to cause W. P. B. to tighten up materially in regards materials and equipment for the water utility industry and keep therein a watchful eye to prevent abuses of the liberal treatment received by the industry operating under Order P-46.

When Mr. Krug takes our own records to show that water utilities have built up inventories of a two year supply of critical materials since the P-46 order was issued as a liberal blanket authority to the water supply industry there is a very long finger pointed at what is presumed to be a representative group from water works management. It clearly indicates that proper regard for the terms of Order P-46 have been violated by the industry which from here on will likely not find the same favors or degree of trust shown it by the W. P. B., which on July 1st assigned an A-1-c rating to water utilities to cover their emergency needs in the way of maintenance, repair and replacements in water works operation, with a reasonable time allowed for looking ahead and ordering replacement parts before failure or break-down actually occurs. Further, in reply to a question by the writer, Mr. Krug stated that it will be permissible to have the suppliers of such emergency equipment to act as agent for a water works needing the equipment or materials in a true emergency, wherein the water works management has not been successful in reaching the proper authority in Washington who can give approval before the order is placed. Mr. Krug did point out, however, that in such cases it is necessary for the water utility to give to the supplier some form of proof of authority to act as its agent in that paricular case.

Back to the violation of the terms of the P-46 order—Mr. Krug, citing records from about 200 of the larger water utilities considered representative, showed that the composite inventory amounted to better than $1,500,000 more at the end of the first quarter of 1942 than was reported for the year 1940. Citing copper and brass pipe as one of the most highly critical items in the inventory, he revealed an inventory for the 200 utilities of $402,000 as against actual use of only $68,000 in the first quarter. Pipe and pipe fittings constituted another particular black spot in the record, the inventory running to $7,500,000 and actual use to only $750,000 and indicative of at least a two years' supply of this class of material on hand—a rather too liberal "working minimum" as set forth in the terms of the P-46 order—one is obliged to admit. Hardly can we dodge the implication against water works management when Mr. Krug states that he regrets that he could not say that water utilities have done a good job in restricting the tieing up of critical metals in the yards of water works.

As a way out of this unsavory situation that most water works managers have unintentionally gotten the industry into, W. P. B. is suggesting that any water utility needing critical materials place its orders against another known to have a surplus beyond the terms "reasonable working minimum." How this is to be worked out he put squarely in the laps of A. W. W. A. If A. W. W. A. or the State Water Coordinators, under whom the Mutual Aid Plan is being formulated, cannot get this matter worked out on some voluntary basis, Mr. Krug sees nothing to do but to set up some plan of pooling all inventories.

Immediately after the Conference Secretary Jordan started the wheels rolling in an effort to assist in getting this situation alleviated. State Water Coordinators have been asked to get started on the plan of re-distribution of surplus. The matter is serious and everyone should take it upon himself to survey his inventory critically and list every bit of material and equipment that can be released—either to other water utilities and offer this list to W. P. B. direct or through A. W. W. A. preferably. This action will make life a lot easier for Harry Jordan and his A. W. W. A. Wartime Practices committee, which has done so much for the industry down in Washington, and of equal importance, make life easier for those in the Power Branch of W. P. B. who have not let water works or sewerage facilities lack for anything at all within reason.

After Mr. Krug's address we heard some good managers say that they had certain pipe and fittings that could be released, another had something else, and another some electric motors. Examine that inventory seriously and make out the list of what A. W. W. A. can report as available for sale to another plant. In short, let's be fair—let's play the game.

L. H. Enslow

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Like many another manufacturer, we shifted to a war time production basis almost overnight. As a part of this program it has been necessary to curtail our sales solicitation in order to use some of our salesmen for other duties.

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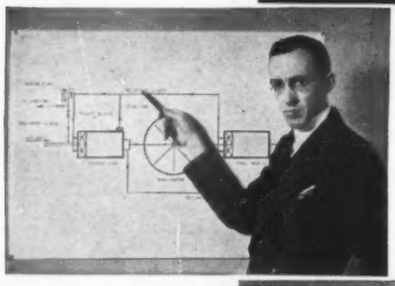

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MEETINGS SCHEDULED

July 22-25—MINNEAPOLIS, MINN. (University of Minnesota)
American Society of Civil Engineers. Secretary, Geo. T. Seabury, 33 West 39th St., New York, N. Y.

Aug. 12—CAMDEN, ME.
Maine Water Utilities Association. Secretary, Earl A. Tarr, Winthrop, Me. (Next meeting Oct. 14th, Fryeburg, Me.)

Aug. 25-28—HOUSTON, TEXAS
American Society Sanitary Engineers. Secretary, J. W. Walker, City Hall, Waterbury, Conn.

Aug. 25-26—HARRISBURG, PA. (Penn-Harris Hotel)
Pennsylvania Sewage Works Operators' Ass'n. (Annual Meeting.) Sec'y, Bernard S. Bush, State Dept. Health, Harrisburg, Pa.
(Note: This meeting has been cancelled.)

Aug. 27—HARRISBURG, PA. (Penn-Harris Hotel)
Pennsylvania Water Works Operators' Ass'n. (Annual Meeting.) Sec'y, I. M. Glace, 22 South 22nd St., Harrisburg, Pa.
(Note: This meeting has been cancelled. The meeting scheduled below for the Western Section of the Pa. Association will be held. The Eastern Section will meet jointly with the Four States Section of A.W.W.A. in Philadelphia, as listed.)

Sept. 9-11—TRAVERSE CITY, MICH. (Park Place Hotel)
Michigan Section, A.W.W.A. Sec'y, M. N. Gerardy, Sup't Water Supply, Water Board Bldg., Detroit, Mich.

(Meeting jointly with)

Michigan Conference on Water Purification. Sec'y, R. J. Faust, Dep't of Health, Lansing, Mich.

Sept. 15-16—BOSTON, MASS. (Hotel Statler)
New England Water Works Association. Sec'y, Frank J. Gifford, 613 Statler Bldg., Boston, Mass.

Sept. 17-18—CHEYENNE, WYOMING (Frontier Hotel)
Rocky Mountain Section A.W.W.A. Secretary, B. V. Howe, 201 Argonaut Hotel, Denver, Colo.

Sept. 17-19—WILLISTON, N. D. (Great Northern Hotel)
North Dakota Water & Sewage Works Conference. Secretary, K. C. Lauster, Bismarck, N. D.

Sept. 18—PITTSBURGH, PA. (Roosevelt Hotel)
Western Pennsylvania Section A.W.W.A. Secretary, E. P. Johnson, 418 Flannery Bldg., Sta. 13, Pittsburgh, Pa.

Sept. 20-22—LOS ANGELES, CALIF. (Hotel Clark)
California Sewage Works Association. (15th Annual Convention.) Sec'y-Treas., Jack H. Kimball, Orange Co. Health Dept., P. O. Box 355, Santa Ana, Calif.

Sept. 24-26—ST. PAUL, MINN. (Lowry Hotel)
Minnesota Section A.W.W.A. Secretary, A. M. Finch, Wallace & Tiernan, Inc., 416 Flour Exchange, Minneapolis, Minn.

Sept. 25—NEW LONDON, CONN. (Ocean Beach Pavilion)
New England Sewage Works Association. (Fall Meeting.) Sec'y-Treas., LeRoy W. VanKleeck, State. Dept. of Health, Hartford, Conn.

Oct. 7-9—PHILADELPHIA, PA. (Benjamin Franklin Hotel)
Four States Section A.W.W.A. Secretary, H. Lloyd Nelson, 1624 Lincoln-Liberty Bldg., Philadelphia, Pa.

MEETINGS SCHEDULED

Oct. 12-14—ROCHESTER, N. Y. (Sagamore Hotel)
American Society Mechanical Engineers. Secretary, 29 West 39th Street, New York, N. Y.

Oct. 12-14—LITTLE ROCK, ARK. (Marion Hotel)
Southwestern Section A.W.W.A. Secretary, Lewis A. Quigley, City Water Works, 3320 W. Berry, Fort Worth, Texas. (Conference War Time Problems.)

Oct. 15-17—CLEVELAND, OHIO (Hotel Statler)
Ohio Conference on Sewage Treatment. (Meeting with Federation of Sewage Works Associations). Sec'y-Treas., W. D. Sheets, 568 E. Broad Street, Columbus, Ohio.

Oct. 18-21—CLEVELAND, OHIO (Statler Hotel)
American Public Works Association. (Annual Public Works Congress.) Exec. Dir., Norman Hebden, 1313 East 60th St., Chicago, Ill.

Oct. 19-21—PADUCAH, KY. (Irving Cobb Hotel)
Kentucky-Tennessee Section A.W.W.A. Secretary, H. D. Schmidt, Div. San. Eng., State Dept. of Health, Nashville, Tenn.

Oct. 20-21—WAUSAU, WISC. (Hotel Wausau)
Wisconsin Section, A.W.W.A. Secretary, Leon A. Smith, Sup't of Water Works, City Hall, Madison, Wis.

Oct. 22-24—ST. LOUIS, MO. (Coronado Hotel)
Missouri Valley Section, A.W.W.A. Sec'y, Earle L. Waterman, 104 Engineering Hall, University of Iowa, Iowa City, Ia.

Oct. 22-24—CLEVELAND, OHIO (Hotel Statler)
Federation Sewage Works Associations. (3rd Annual Convention.) Sec'y, H. W. Wisely, Urbana-Champaign Sanitary District, Urbana, Ill.
(In conjunction with Ohio Conference on Sewage Treatment.)

Oct. 27-30—ST. LOUIS, MO. (Jefferson & Statler Hotels)
American Public Health Association. Exec.-Sec'y, Dr. Reginald M. Atwater, 50 West 50th St., New York, N. Y.

Oct. 28-30—OAKLAND, CALIF. (Hotel Oakland)
California Section, A.W.W.A. Sec'y, H. Arthur Price, Dept. Water and Power, 316 West 2nd St., Los Angeles, Calif.

Nov. 2-4—DURHAM, N. C. (Washington Duke Hotel)
North Carolina Section, A.W.W.A. Sec'y, R. S. Phillips, Chief Chemist, Water Department, 206 Dacian Ave., Durham, N. C.

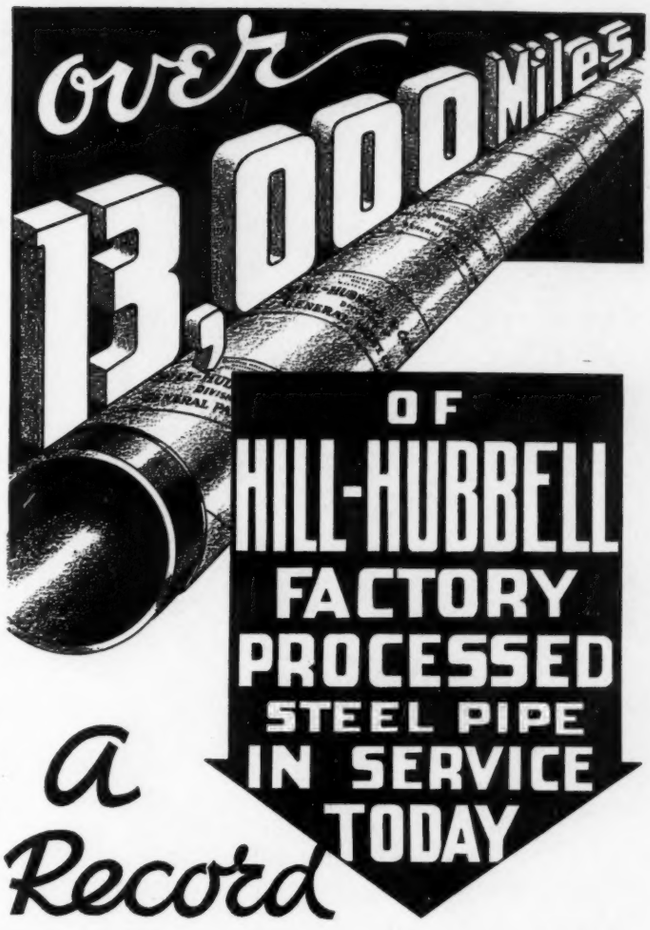
(Meeting jointly with)

North Carolina Sewage Works Ass'n. (22nd Annual Meeting). Sec'y-Treas., R. S. Phillips, 206 Dacian Ave., Durham, N. C.

Nov. 5-6—(Place not decided)
Virginia Section, A.W.W.A. Secretary, F. H. Miller, Ass't Engr., Bureau of Sanitary Engineering, Dept. of Health, Richmond, Va.

Nov. 9-10—HANNIBAL, MO. (Mark Twain Hotel)
Missouri Water & Sewerage Conference. Sec'y-Treas., W. A. Kramer, State Board of Health, Jefferson City, Mo.

Nov. 12-14—MIAMI, FLA.
Florida Section, A.W.W.A. Secretary, A. P. Black, Prof. of Agricultural Chemistry, University of Florida, Gainesville, Fla.



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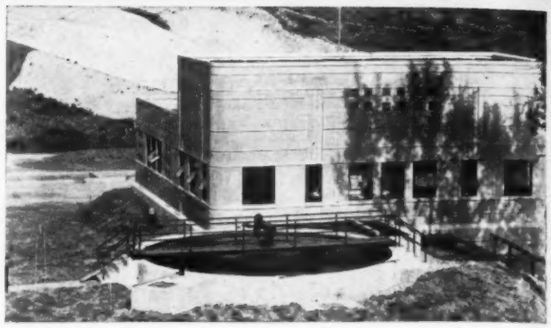

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LITERATURE AND CATALOGS

"Micromet"—by Calgon, is the newest scale preventer and corrosion suppressing agent produced by Calgon, Inc., well known for their hexametaphosphate marketed under the trade name "Calgon" (coined expression for calcium-gone) before it became established that this product possessed marked inhibiting powers in corrosion control, as it has in stabilizing hard and partially softened waters to prevent after precipitation of calcium compounds in pipe lines, meters, etc., and hard scale in hot water systems. As we understand it, "Micromet" is a modified "Calgon"—in truth, is "Calgon" with a glass-like structure which renders it so slightly soluble as to permit a flow of cold water through a chamber filled with it to dissolve only that quantity needed for scale and corrosion prevention, thus simplifying its use in small systems, hotels, homes, etc., because dosage control becomes automatic and waste is precluded. An interesting booklet by Calgon, Inc., tells of the nature and use of "Micromet" and describes with illustrations the exact methods of its adaptation to scale and corrosion suppression in small water supplies, household systems, air conditioning units and in mechanical washers for dishes, bottles, etc.

We once said that "Calgon" sounded to us like "the answer to a maiden's prayer." It appears now that "micromet" is to be the answer in fact, although many a maiden now to be benefited may have come to be "full bloom roses."

Any water works operator who introduces "micromet" to a hard-to-get along-with customer, suffering from "red-water complaint" or "scale troubles," will have made a friend. We recommend studying this "micromet" booklet and putting its contents to good use. For a copy (or copies for handing out to customers may be had) write Owen Price, Development Engineer, Calgon, Inc., Hogan Bldg., Pittsburgh, Pa.

"Wrought Iron in Sewage Works" is the title of an extremely well put together technical bulletin of 28 pages published by the A. M. Byers Co., a name long associated with wrought iron. This bulletin, with a large number of illustrations, reveals the many applications and actual pictured uses of wrought iron piping and other parts of this corrosion resisting material in and around sew-

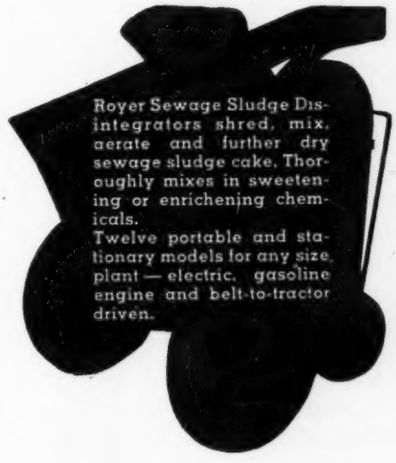
(Continued next page)

They Pooh-Poohed the Idea of Salvaging Tin Cans!

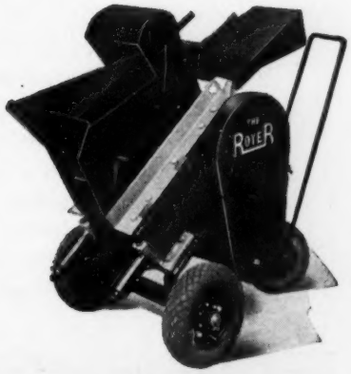
Yet, today, scores of cities have a drive on to get housekeepers to save and turn in empty, collapsed tin cans so that the steel and tin in them can be salvaged for much needed war material. Other cities salvage them at rubbish disposal plants.

But sewage sludge, far more valuable and far easier to salvage, is still wasted by many cities. And an even worse sin is the unnecessary expense many cities have been obligated with, for costly sludge incinerating equipment.

Any who pooh-pooh the salvage of dried sludge cake for use as fertilizer have only to look at the results obtained by hundreds of cities, at home and abroad, that make use of their properly prepared sewage solids. Every farmer highly prizes barn manures which, in most cases, are only slightly higher in plant nutrition values than sludge. Ever hear of manure being burned or wasted? Then why waste earth-enrichening sludge? Aid our war effort by warring on waste! Send for portfolio of authentic data!



Royer Sewage Sludge Disintegrators shred, mix, aerate and further dry sewage sludge cake. Thoroughly mixes in sweetening or enrichening chemicals.
Twelve portable and stationary models for any size plant — electric, gasoline engine and belt-to-tractor driven.



MODEL NSB-4

THE ROYER

ROYER FOUNDRY & MACHINE CO.
170 PRINGLE ST., KINGSTON, PA.

age treatment plants. From the impressive number of uses covered, only a few are gas, air, hot and cold water piping; digester heating coils; chlorine lines; railings; rotary distributor arms; sewer outfall lines into salt water; tanks (air, water or effluent); bar screens; chemical storage (bins and tanks); clarifier and digester mechanisms; weir plates; ventilating ducts; skimming troughs; manhole steps; stirring and flocculating mechanisms, etc.

Of particular interest to this reviewer is the history and record of a number of outfall lines of wrought-iron plate construction which have given long service life in salt water. Other varied applications of this corrosion resistant material are treated by representative plants and also by various uses. This booklet, produced especially for operating engineers and plant designers, should go far in the direction of advancing the use of wrought iron where most serviceable as a sewage works material. Its points of advantage for specific uses are well presented. And we can't refrain from complimenting the producers on the style of presentation and the attractive symphony of color on the front cover—a sewage works interior which would do any water works plant proud. For a copy of this illuminating and readable bulletin—"Wrought Iron for Sewage Works"—write A. M. Byers Co., Pittsburgh, Pa.

New Pump Data Sheets have been produced by Goulds Pumps of Seneca Falls, N. Y., as a special wartime service to pump buyers and operators. These "Pump Application Sheets," for the first time made available outside of the Gould organization, were originally prepared for the confidential use of its own service engineers and salesmen. These so-called sheets, of two to eight pages each, include both elemetnary and advanced technical data on selection, installation, operation and maintenance of all types of pumps.

The sheets and an 18-page booklet presenting "Pump Fundamentals" are furnished without charge in a durable file folder. From six to fourteen sheets will be placed in each folder, depending upon the type of information deemed most useful to the recipient. Additional copies of individual sheets, or of the complete folder, will be furnished on request without charge. The sheets deal with "Priming Methods"; "Hydraulic Data" of general application; "New Pumps vs. Old"; "Pumping Thick Liquids, Sludges, etc.," and a most useful sheet is the "Guide to Locating Pump Troubles," which covers all types of pumps.

The more elementary sheets should prove of great assistance in training new, inexperienced employees, while the more technical sheets should help operators get maximum performance from existing equipment, regardless of its manufacture. For a copy of this useful pump data folder write Goulds Pumps, Inc. (Water and Sewage Div.), Seneca Falls, N. Y.

"No Drip" is the plastic granulated cork insulating coating for stopping the sweating of pipes, pumps, tanks, ceilings and walls now described in a new technical bulletin from the J. W. Mortell Co. of Kankakee, Ill. The coating, applied with brush or trowel, not only stops sweating and drop but also has anti-corrosion and sound deadening properties. The bulletin points out that the surfaces do not have to be dry when "No-Drip" is applied and amongst other things gives examples of how to estimate quantities required for various applications. Anyone having surface sweating prob-

TRAFFIC smash? If your hydrant is a Mathews you don't sweat it back into readiness with pick and shovel and pavement breaker. You simply change it like a tire. You unscrew the broken barrel from its elbow—it contains all operating parts—lift it out through its loose protection case, and replace it with a spare. You repair the barrel at your own convenience in the shop. You save the community money, time, and fire protection. You enjoy a completely interchangeable, overhaulable, frost-proof hydrant system. You have the maximum defense in case of bombing. You have Mathews Hydrants, the standard of fire protection for over 70 years.

MATHEWS HYDRANTS
400 CHESTNUT STREET, PHILADELPHIA, PA.
ESTABLISHED IN 1803
Made by R.D. WOOD Company
MANUFACTURERS OF SAND SPUN PIPE (CENTRIFUGALLY CAST IN SAND MOLDS) AND R. D. WOOD GATE VALVES

lems will find the "No-Drip" bulletin of considerable interest. For a copy write the J. W. Mortell Co., Kankakee, Ill.

Filter Under-drain Blocks are the subject of a new bulletin from "Natco" of Pittsburgh, devoted exclusively to Natco Unifilter Vitrified Blocks for trickling filter underdrains. The Standard Unifilter Block with its smooth egg shaped drain channels is presented in detail and typical plant installations are pictured and listed. Also pictured and detailed are Natco Segmentals with steel reinforcement for constructing circular filter walls. Typical filter design drawings reveal alternate methods of construction and adaptations of Unifilter Blocks for the under-drainage structure. For a copy of this guide to trickling filter construction write National Fireproofing Corp., Pittsburgh, Pa.

"Fifty Years of Chemical Progress" is the title of the new, handsomely printed, 46-page anniversary book of the Mathieson Alkali Works, commemorating their 50th year as a manufacturer of chemical products. From the beginning of negotiations in 1892 to obtain the salt properties of the Holston Salt and Plaster Co. at Saltville, Va., through numerous stages of expansion, construction of new plants, this interesting book traces the growth of the Mathieson organization up to its present greatness. Besides the original plant at Saltville, Va., Mathieson now has extensive works at Niagara Falls and at Lake Charles, Louisiana. Salt cake, bicarbonate of soda, anhydrous ammonia, liquid chlorine, bleaching powder, and dry ice are some of their most common products. The book is profusely illustrated and contains flow charts showing their ammonia-soda and electrolytic processes. Anyone desiring a copy of this interesting portrayal of Mathieson history should write to the Mathieson Alkali Works, Inc., 60 E. 42nd St., New York, N. Y.

Asarco Type K Tube-Loy and Grinnell Superseal Flared Tube-Loy Fittings—two products becoming increasingly popular with the allocation of strategic materials—are comprehensively described in a new illustrated catalogue. Type K Tube-Loy, a water service pipe developed by the American Smelting and Refining Company and marketed by them in 1940, is extruded from an alloy of lead, magnesium, calcium and tin. The recommended fittings are a product of the Grinnell Company of Providence, R. I. They are of malleable iron, expertly galvanized to resist corrosion, and featuring a long tapering flare that provides greater contact between the fitting and the lead-alloy pipe.

Tube-Loy is available in sizes from 3/8 to 1 inch, and to withstand pressures up to 125 pounds per square inch. Proof of its serviceability is demonstrated by a series of tables showing tests of bursting pressure, distention under pressure, and distention under bursting pressure. The catalogue contains installation instructions and a tabulation of list prices. Also shown are illustrations of the extrusion of Tube-Loy and the machining of Grinnell fittings. For a copy of the catalogue and additional information on both products, write American Smelting and Refining Company, Lead Products Div., 120 Broadway, New York, N. Y.

BUY WAR BONDS AND SAVINGS STAMPS

Portsmouth, Va., with a heavy influx of Navy Yard workers, increased its water supply from 6,000,000 to 13,000,000 gallons per day by building a 13-mile water line of 30-in. concrete pipe. Laying crew placed 400 ft. of pipe daily.

Defense-area water and sewerage projects need the durability and economy of

CONCRETE PIPE

Concrete pipe has proved its durability on a vast scale, with installations dating back half a century and more. While conserving critical materials, it fully meets ALL the requirements of moderate first cost, structural safety, minimum infiltration and leakage, and maximum hydraulic capacity.

Technical assistance is available to engineers and builders engaged in vital wartime projects involving concrete pipe or other concrete construction.

PORTLAND CEMENT ASSOCIATION
Dept. 7-29, 33 W. Grand Ave., Chicago, Ill.

A national organization to improve and extend the uses of concrete . . . through scientific research and engineering field work

BUY DEFENSE STAMPS AND BONDS . . . SUPPORT THE RED CROSS

Layne Quality

Has Set A World Standard!

Efficiency, Ruggedness and Long Life are the three outstanding and world recognized features of Layne Well Water Systems. Those features are the result of more than sixty years of water producing experience, specialized engineering skill and ceaseless endeavor to build better pumps and wells.

Thousands of Layne Well Water Systems are now serving, and have long served leading industrial plants, railroads, irrigation projects and municipalities throughout the United States and the Dominion of Canada. Hundreds also, are in use in foreign countries throughout the world.

Each Layne unit is designed and custom built to fulfill its particular task—the production of the largest quantity of water at the lowest possible operating cost. Various parts of the systems; pumps and component pump parts, motors, etc., are of standard manufacture and dimensions. Thus, repairs or replacements, when required, may be made at minimum cost. Each system is completed as a unit, then thoroughly tested and delivered in operation.

For literature showing superior construction and engineering details, address,

LAYNE & BOWLER, INC.
Memphis, Tenn.

LAYNE PUMPS & WELL WATER SYSTEMS

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Layne-Arkansas Company	Stuttgart, Ark.
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Louisiana Well Company	Monroe, La.
Layne-New York Company	New York City
Layne-Northwest Company	Milwaukee, Wis.
Layne-Ohio Company	Columbus, Ohio
Layne-Texas Company	Houston, Texas.
Layne-Western Company	Kansas City, Mo.
Layne-Western Co. of Minn.	Minneapolis, Minn.
International Water Supply, Ltd.	London, Ont.

WORLD'S LARGEST WATER DEVELOPERS

EQUIPMENT NEWS

The 'Multdigestor' Combines Two Digesters in One

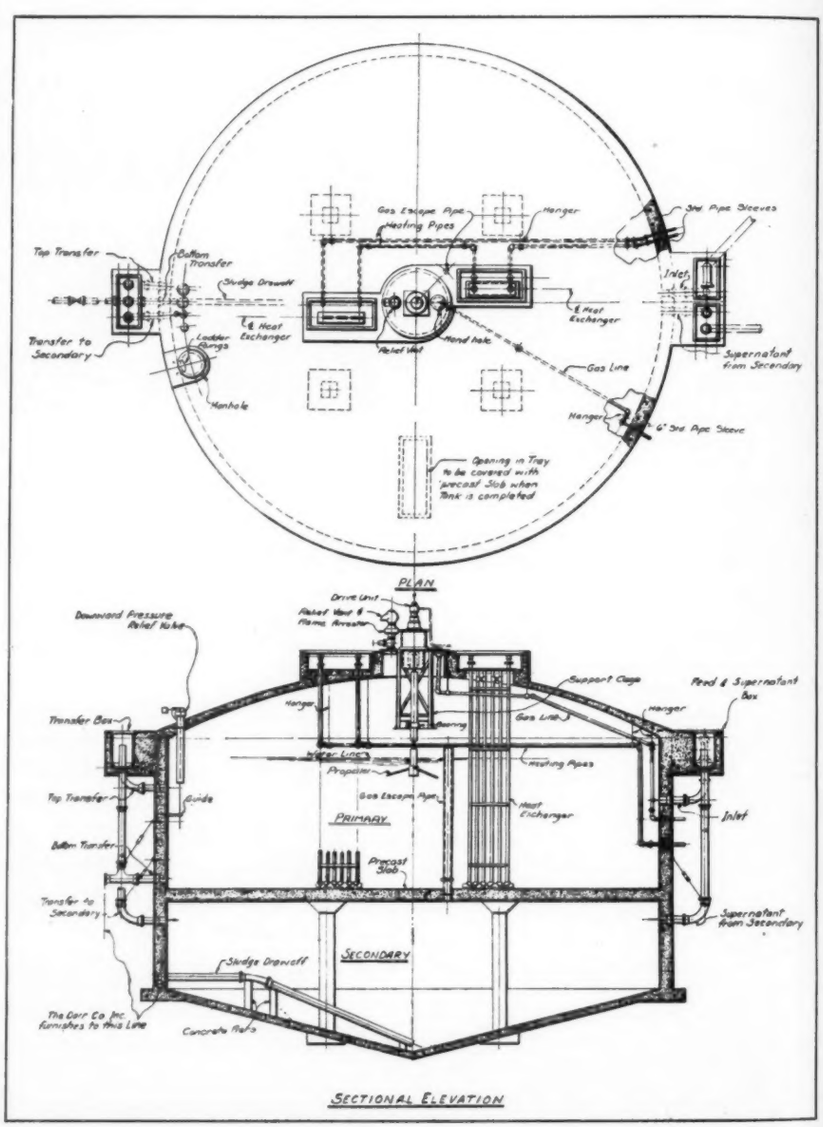
• The "Multdigestor" just announced by the Dorr Co. is a two-story digestor which offers all advantages of two-stage digestion of sewage sludge and features the economy of single tank construction.

As the accompanying illustration reveals the "Multdigestor" is a single tank with a separating floor about two-thirds way down to provide an agitated heated primary digestor above and an unheated compartment beneath for the secondary digestion, the little warmth needed coming from the heated compartment above. The lower compartment requires no stirring and sludge thickening proceeds naturally.

Some of the distinctive advantages cited for the "Multdigestor" are these: (1) Less costly to construct and occupies less ground area; (2) No foaming; (3) Heavier final sludge; (4) Higher permissible solids loading. Greatest of all these is the economy and simplicity of construction.

Dorr Co. supplies everything needed to complete this two-in-one digester; except the tank proper. Dimensions run to 65 ft. and depths to 35 ft.

For further details concerning the mechanical equipment, heating, piping, etc., address the Dorr Co., 570 Lexington Ave., New York, N. Y.



Safety "Pipettor"

● The accompanying illustration very effectively tells its own story. Laboratory workers no longer need suck up solutions in pipettes nor use their fingers over the tube to control the discharge of a graduated pipette. The new Caulfield Pipettor voids this sometimes dangerous and always tedious practice.

The Caulfield Pipettor consists of a rubber bulb over a cleverly devised valve, with an extremely sensitive valve control at the top. It will draw up any desired quantity and accurately discharge to less than 1/100 of a c.c. At the lower end, or mouth, a soft bushing permits the easy insertion of any size pipette. A neat three sided, polished hard rubber frame 2"x 4¾", supports the controls.

The Pipettor is light and convenient to hold and operate. With its positive check valve, hair-line accuracy results and drop splitting can be had. It can be used wherever burettes have formerly been used and the pipette is especially useful for field-kits when used with the positive control Pipettor.

For further details and price, address The Campbell Co. (Laboratory Supplies) Hommonton, N. J.

"Fibrex" New Victory Packing

● "Fibrex" is the new Victory packing being offered by Hydraulic Development Corp. The new packing takes the place of braided jute in making pipe line joints.

Fibrex has a water repellent core and strong woven paper covering, which packs into a joint in exactly the same manner as braided jute. Fibrex has all the advantages of braided jute and will not breed bacteria. Fibrex is lighter in weight than jute and only 70% of the usual number of pounds is required. It is made in ⅜", ½" and

(Continued next page)

· AERATORS · SIPHONS · WATER SYSTEMS ·

SLUDGE PUMPS · FLOCCERS · CONDITIONERS · MIXERS

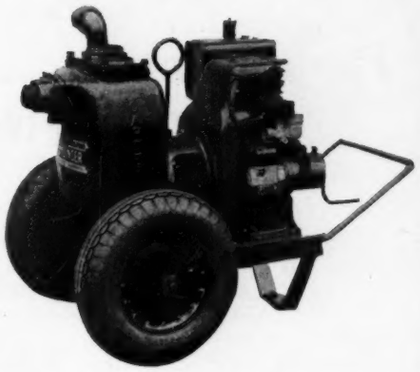
SELF PRIMING CENTRIFUGAL PUMPS · HUMDINGER PUMPS

CARTER

PORTABLE SELF PRIMING PUMPS

For . . . . .

Pumping Out Imhoff and Other Type Settling Tanks . . . Breaking Scum . . . Washing Down Tank Sides . . . General Plant Usage.



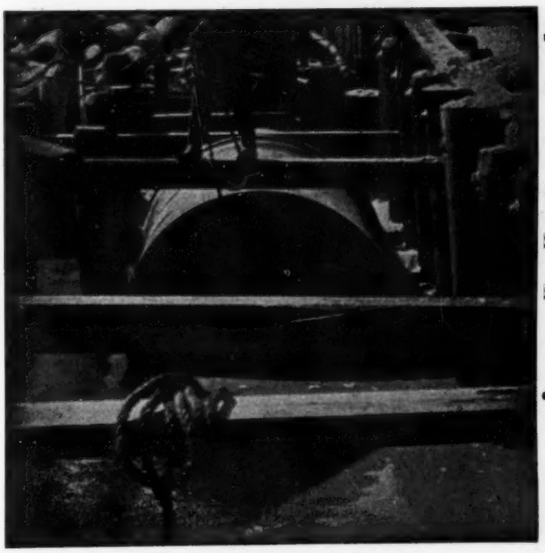
. . . Humdinger

The HUMDINGER Portable Embodies the Same CARTER Self-Priming Principles as Standardized on by the United States Navy for Use on All U. S. Destroyers and Sub-Chasers.

RALPH B. CARTER COMPANY

NEW YORK OFFICE
53 PARK PLACE

HACKENSACK · NEW JERSEY



84" pipe—Spring Lake, N. J.

FLANGED PIPE

FLEXIBLE JOINT PIPE

BELL & SPIGOT PIPE

SPECIAL CASTINGS

SHORT BODY BELL & SPIGOT SPECIALS

Large stock enables us to make prompt shipments.

CAST IRON PIPE

SIZES 2" TO 84"

Warren Foundry & Pipe Corp.

11 Broadway, New York

Warren Pipe Company of Mass., Inc.

75 Federal St., Boston

Permanent . . . . .

REDWOOD PIPE Saves critical materials! Long known as a pipe with greater carrying capacity than metal or concrete. Does not clog, scale or pit.

LOWER labor, installation and maintenance costs. Long life, no electrolysis, contamination of water, or destruction by sulphur, salt water or other mineral impurities. New type Wyckoff California Redwood Pipe for water supply and sewage lines is a proven product.

A. Wyckoff & Son Company

ELMIRA, N. Y.

Originators of Machine Made Wood Pipe

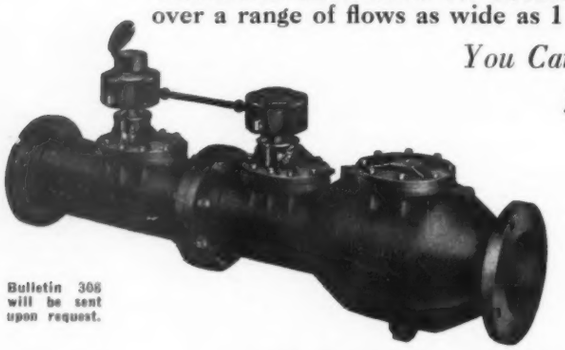
1855 — Our 87th Anniversary — 1942

SPARLING

WATER MAIN LINE METERS

COMPOUND WATER METERS for Community Main-Line Service

Here is one of the 44 types and sizes of Sparling COMPOUND Meters for accurate measurement over a range of flows as wide as 1 to 120.



Bulletin 306 will be sent upon request.

You Can Depend on Them for

CONSISTENT ACCURACY

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EASE OF INSTALLATION

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LOW LOSS OF HEAD

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ALL-'ROUND ECONOMY

P. W. SPARLING

LOS ANGELES.....Box 3277, Terminal Annex
CHICAGO.....3104 S. Michigan Avenue
622 Broadway.....CINCINNATI
101 Park Avenue.....NEW YORK

5/8" sizes and we understand that prompt shipments from stock can be made.

For further information and a price list, write Hydraulic Development Corp., 50 Church St., New York City.

Pittsburgh-National Introduces "Ironside" Disc Meter

• The "Ironside" Disc Water Meter was shown for the first time at the exhibit held in connection with the American Water Works Association Conference on Wartime Water Works Problems in Chicago.

Rust-proof cast iron and molded glass have been ingeniously substituted for bronze in the outer shell, register box and register lid, making possible a construction in which over 70 per cent of the bronze normally used in a meter of this size has been eliminated. The manufacturer states that the vital inner working mechanism, which has been time-tested and proven in hundreds of thousands of Pittsburgh Arctic and Tropic Meters, requires only a small quantity of critical material. Special care has been devoted to protecting the cast iron surfaces from rust and corrosion. Three separate coatings are applied to the outer casing both inside and out.

The "Ironside" is fitted with a molded glass register box, a recent development from the Pittsburgh-National Laboratories. This is described as a single piece, strong molded glass unit which fits snugly over the register and is retained by two screws against a fiber gasket. This glass register box is designed to serve as both a register box and lid. The manufacturer states that it tightly seals the register against dust and moisture and has sufficient strength to withstand considerable abuse.

As previously stated, the inner working mechanism is the same as has been successfully used in the company's Arctic and Tropic model meters. Features claimed are a snap-joint measuring chamber; three-part molded disc and a completely bushed oil enclosed intermediate train.

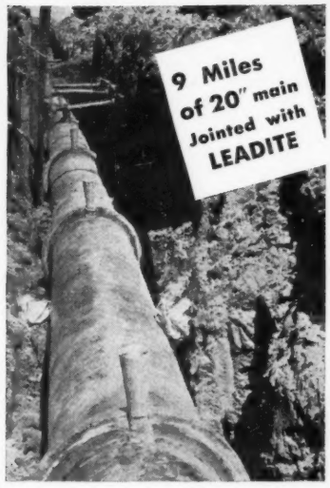
The "Ironside" meter is made in sizes from 5/8"x3/4" up to, and including 2". A new bulletin has been prepared,

WATER

To keep running water from running away from you we prescribe your reading TESTING WATER METERS, WHY, WHEN & HOW, a forty page book just off the press which will be sent without charge to any water works man who will write for a copy.

FORD METER BOX CO.,
WABASH, IND.

LEADITE
Trade Mark Registered U. S. Pat. Office
The Pioneer Self-Caulking Material for C.I. Pipe



Whether rough going or smooth, Leadite, for more than 40 years, has proved itself to be a very dependable self-caulking material that makes a good, tight, lasting joint!

THE LEADITE COMPANY
Girard Trust Co. Bldg. Philadelphia, Pa.

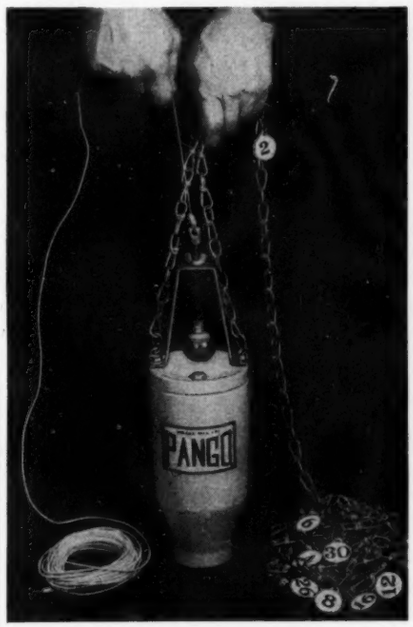
No Caulking

copies of which can be obtained by writing to the Pittsburgh Equitable Meter Co., 400 North Lexington Ave., Pittsburgh, Pa., or to any branch office of the company.

Pango Sewage and Sludge Sampler

● A few issues back carried a brief article describing an ingenious sewage and sludge sampler designed and built by Chester Proudman, Sup't of Sewerage at New Canaan, Conn., and Henry Goossen.

Announcement has just been received from the Drake Mfg. Co. of Philadelphia, offering the "Pango" Sampler which is the original New Canaan sampler with improvements and a more attractive "dress".



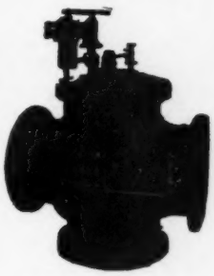
The Pango Sampler is a steel chamber which is lowered into the tank by a sturdy, twin link chain, which carries markings showing the various depths. The chamber is fitted with a valve mechanism operated by a cord. When the sampler reaches the desired depth, as indicated by the markers, a slight pull on the cord opens the valves and the liquid or sludge flows into the chamber through the bottom valve, while the air escapes through the top valve. At the lower levels the pressure variation actually forces the heavier sludge into the chamber. Releasing the valve cord closes the valves, which automatically seat themselves, sealing the chamber and contents, preventing a dilution while sampler is withdrawn; consequently the sample obtained is a true and accurate sample taken at the depth indicated.

For sampling sludge digesters the sampler has sufficient weight (approximately 18 pounds) to go through the top scum and take an accurate sample at the desired depth. Its use will establish the clear liquor zone, and find the

·1879·
ROSS
·AUTOMATIC VALVES

ALTITUDE VALVES
for
Control of elevation and heads into and out of tanks, basins and reservoirs.
1. Single acting.
2. Double acting.
3. Combination assembly for three or more automatic operations.

COMBINATION VALVE
Combination automatic control both directions through the valve.
A self-contained unit, with three or more automatic controls.



REMOTE CONTROL VALVE
Electric remote control—solenoid or motor can be furnished.
Adapted for use as primary or secondary control on any of the hydraulically controlled or operated valves.

ROSS VALVE MFG. CO.
INCORPORATED
P. O. BOX 595, TROY, N. Y.

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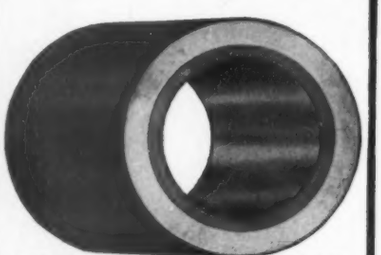
THE JOINTS ARE LAPPED
LIPCO PIPE
AVAILABLE Now!
Immediate DELIVERY
ON
STEEL, TONCAN IRON
AND WROUGHT IRON
Cement Lined Service Pipe

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Lynn, Mass.

AER-O-MIX
AERATOR - MIXER

Down-Draft Type
MECHANICAL
SEWAGE AERATORS

Write for information on AER-O-MIX for your SEWAGE or WATER TREATMENT APPLICATION.
VOGT MFG. CO.
INCORPORATED
P. O. Box 1122 Louisville, Ky.

top level of the bottom sludge.

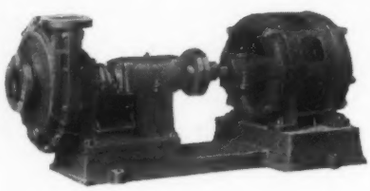
The Sampler empties its contents where desired merely by a pull on the valve cord.

With the sampler a complete check can be made of both the primary tank and the clarifier, to make certain that all the sludge has been pumped out. It gives a dependable check on the operation of the pumps in the system.

The Pango Sampler is 4 inches in diameter and 9 inches in height. The manufacturers have just issued a descriptive folder on the Sampler, in which a trial of it is invited on a no-charge basis if returned in good order.

For a copy of this Pango Sampler folder and additional information, write Drake Mfg. Co., 1461 Belfield Ave., Philadelphia, Pa.

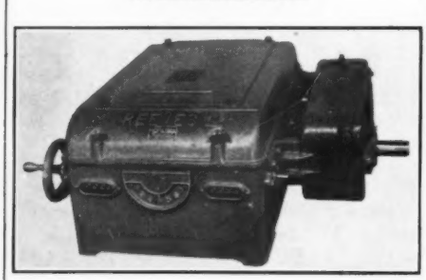
Olivite Pumps Now Available in 2" Size



● Oliver United Filters, Inc., are now producing the famed Olivite acid handling pump in a 2-inch size. At the same time the re-design of the unit has resulted in a new efficiency 20 to 25% higher than attained heretofore. The weight of "Olivite" pumps has been decreased by substituting high tensile strength chemically resistant plastic impellers, lantern rings, split glands and sleeves. This change has reduced impeller weight by 50%, with also lessened overhang weight on the shaft.

For a descriptive bulletin write Oliver United Filters, Inc., 33 W. 42nd St., New York City.

Reeves Improved Speed Transmission



● Reeves Pulley is now offering a special design of the Reeves Variable Speed Transmission, enclosed design, equipped with built-in chain reducer, and with the output shaft in exact alignment with the input shaft. The chain drive operates in a bath of oil.

Output speeds may be either in-

A Proven Coagulant
For water and waste treatment. Chemical costs greatly reduced by using FERRI-FLOC for sludge conditioning
Send for literature.
Ferri-Floc
FERRIC SULPHATE
Tennessee Corporation
ATLANTA, GA. LOCKLAND, OHIO

HYDRO-TITE
A DEPENDABLE self-caulking joint compound used to joint cast iron bell and spigot pipe. Much easier to use than lead and makes stronger, more flexible and tighter joints.
Employed on thousands of miles of pipe from 4" to 60". Write for our free trial offer.
HYDRAULIC DEVELOPMENT CORPORATION
MAIN SALES OFFICE - 50 CHURCH STREET, NEW YORK
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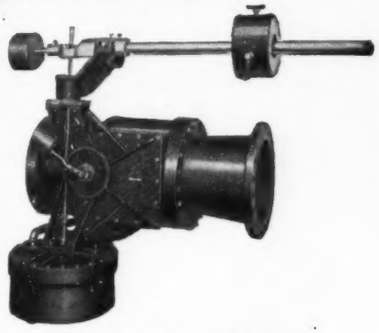
OVER 25 YEARS WITHOUT A FAILURE

BUILDERS
WATER AND SEWAGE PLANT
Instruments

Type E Direct-Acting Controllers

Features include: precise control; compact, yet flexible design; powerful "floating piston" actuation with unique rubber piston seal; low loss of head; elbow outlet or straight through design; single blade vane-type valve; generous use of corrosion-resisting materials; and the use of the basic Venturi Tube.



Write for Bulletin 321

BUILDERS-PROVIDENCE, INC.
Division of Builders Iron Foundry
9 Codding Street Providence, R. I.

INQUIRIES INVITED
on all Problems of
WATER TREATMENT

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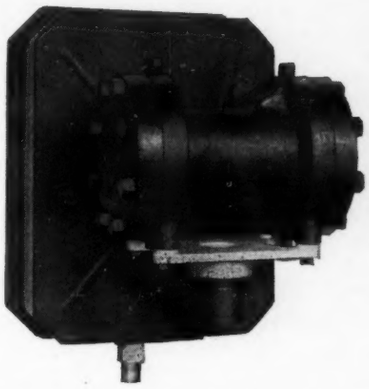
creased or decreased as compared to the variable speed shaft of the Transmission, and of course infinitely variable, within predetermined limits, by turning the speed control handwheel.

For further details write Reeves Pulley Co., Columbus, Ind.

Mercuryless Taylor Anaeroid Manometer



● Taylor Instrument Companies announce a new design of Anaeroid Manometer, for indicating flow and/or liquid level, which employs no mercury or other liquid. The new Taylor Monometer removes the possibility of mercury being blown and lost due to line surges or carelessness. Further, vital mercury is released for the war effort.

Replacing the stuffing box is a new torque tube assembly which gives a completely closed system and is designed so as to eliminate friction and lubrication. This new assembly also does away with the lost time involved in maintenance. Friction, lost motion and wear are further reduced by the absence of internal pivots and springs.

Sturdy metal bellows, built to withstand high over-range, respond to the pressure variations with fast response and immediate reaction to sudden changes in flow.

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For further descriptive bulletin on this interesting manometer, and further information, write the Taylor Instrument Companies, Rochester, N. Y.

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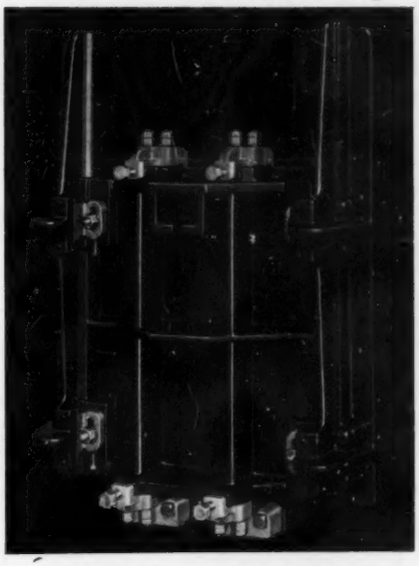
AND SAVINGS STAMPS



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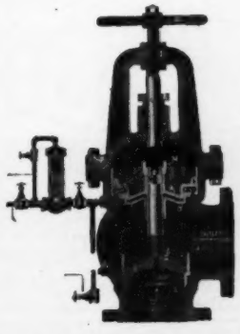

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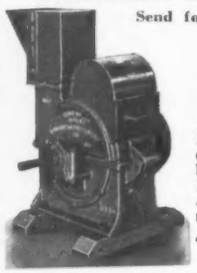

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WITH THE MANUFACTURERS

Fred Kurz of Eimco Passes

● Frederick E. Kurz, Central Division Manager for the Eimco Corporation, died July 10, 1942, at the age of 51 after an illness of two months.

Fred. Kurz was a graduate of the Michigan School of Mines and served as lieutenant in the Corps of Engineers during the first World War. He had been actively engaged in the mining and filtration equipment fields during the past twenty-five years. To those in the sanitary field he was best known for his connection with the development and marketing of the Eimco Vacuum Filter for sludge dewatering.

Ellsworth New Vice-President of Eastern Advertisers Ass'n.

● Harry M. Ellsworth, advertising manager of Pennsylvania Salt Mfg. Co., has been elected vice president of the Eastern Industrial Advertisers Association for the 1942-43 term. Mr. Ellsworth also serves as chairman of the employment section for the Eastern district of the National Industrial Advertisers Association.

P.D.M. Establishes Research Fellowship in Mellon Institute

● Announcement is made of the establishment of a multiple fellowship on chemical containers and storage by Pittsburgh-Des Moines Steel Co. at Mellon Institute of Industrial Research, Pittsburgh. The senior incumbent of the Fellowship is Dr. James Bert Garner, a distinguished chemical engineer. He is aided by Ludwig Adams, a specialist in engineering materials and welding, and by R. M. Stuchell, a research metallurgist.

This broad and much needed research work will lead to reports containing recommendations as to the most suitable types of containers, the most appropriate materials of construction, and the proper temperatures and pressures for storage of liquid and gaseous commodities, also charts indicating the most economical storage conditions for various annual turnovers. The investigational findings will also include recommendations for linings and coatings for the protection of both containers and substances being stored. Requests for advice on the storage of any material should be made to this company's research department, which will arrange for the pertinent recommendation at once or after any necessary investigation.

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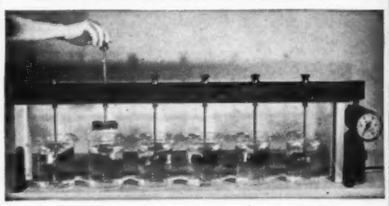
THE *Phipps & Bird* LABORATORY MIXER . . .



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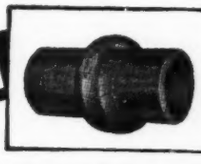

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Rockwell Heads Production for Maritime Commission

● Colonel W. F. Rockwell, president, Pittsburgh Equitable Meter Co., has been serving as Director of Production for the Maritime Commission in Washington.

During the few months in which he has devoted his principal attention to the production problems of the intensified shipbuilding program, Colonel Rockwell has been instrumental in accelerating the output of the shipyards to a point hitherto unequalled by any country in the world. According to the Colonel, U. S. shipyard production is now limited only by the capacity of the steel mills and not by the capacity of the shipbuilders.

In addition to Colonel Rockwell's duties with the Maritime Commission, he also serves as a member of the Executive Committee, Army and Navy Munitions Board and the War Production Board.

Pomona Pump Elects C. G. Bonner Treasurer

● C. Granniss Bonner, formerly comptroller and more recently treasurer of the Brunswick-Balke-Collender Co. of Chicago, has been elected treasurer of Pomona Pump Co. of California.

Bonnor relieves Donald C. McKenna, vice-president, and former treasurer, who will devote full time to the increasing production activities of the company's four manufacturing plants.

The new treasurer is 45, a graduate of Swarthmore College with A.B. and M.E. degrees, a Phi Delta Theta and a member of the Controllers Institute of America.

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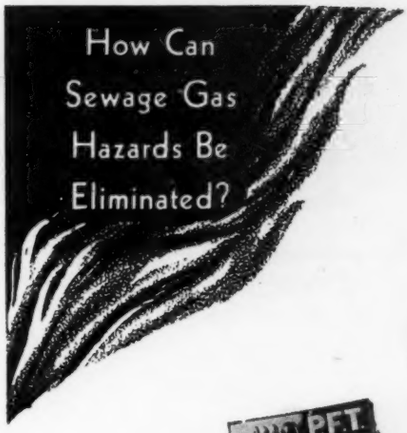

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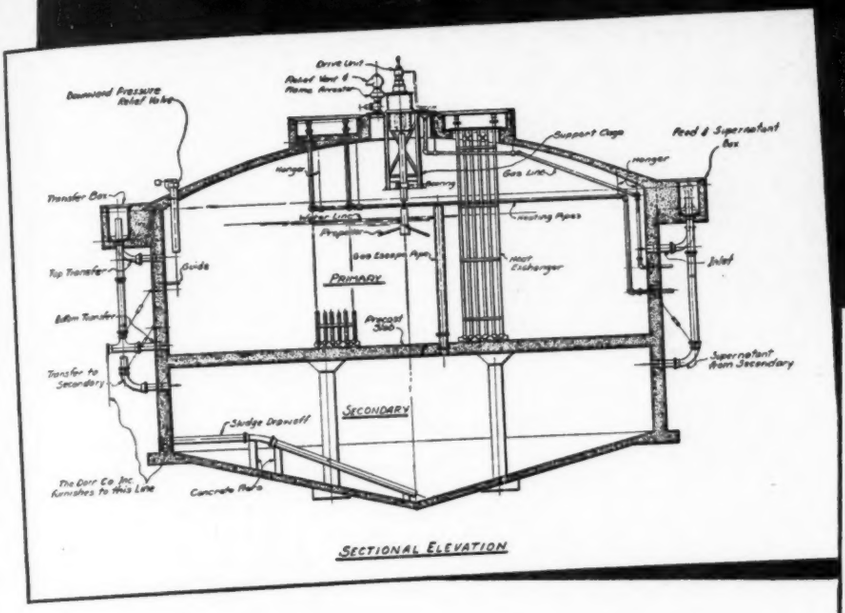
Announcing

THE DORR MULTDIGESTOR



SECTIONAL ELEVATION

TWO ALTERNATIVE TYPES

DOME TOP FLAT TOP

DORR MULTDIGESTOR ADVANTAGES*

★ **Maximum Gas Production**—20 to 25 cubic feet per pound of volatile matter destroyed, which is one third or more greater than in plain non-stirred and non-heated digesters.

★ **Maximum Solids Reduction**—60 to 65 per cent of the total solids and 80 to 85 per cent of the volatile matter.

★ **High Solids Loadings**—up to 50 per cent more pounds of solids per month per cubic foot of tankage.

★ **Short, Easy, Start-ups**—stable balanced operation within 3 to 4 weeks, with the unit producing a combustible gas and a fully digested, granular sludge.

★ **No Foaming**—because of the mechanical destruction of foam and scum and the rapid, homogeneous mixing and heating.

★ **Heavy Final Sludge**—because of the undisturbed thickening in the secondary compartment which yields a dense product ideally adapted to drying, filtration or incineration.

*Identical with those of the Dorr Multdigestion System.

Multiple-Stage Digestion In A Single Tank

★ The Dorr Multdigestor does in a single tank everything that is done in a two-tank Dorr Multdigestion System, except that it does not store gas. The advantages of these two methods of digesting sewage sludge are identical and are enumerated at the right.

The Dorr Multdigestor consists of a covered concrete tank divided into two compartments by a concrete tray. In the upper primary compartment—a homogeneous, mechanically-stirred sludge, heated to the optimum temperature. In the lower, secondary compartment—quiescent settling and thickening to maximum discharge density.

Steel plate, vitally needed for the War Effort, has been "designed out" and replaced with concrete. The Multdigestor is supplied complete, except, of course, for the tank. All the mechanical features, heating coils, interconnecting pipe lines and other appurtenances shown in this drawing are furnished by us.

Single-tank construction, as provided in the Dorr Multdigestor, is simpler mechanically, less expensive, and occupies less ground area than the two-tank design. Diameters range up to 65 feet, depths to 35 feet, and design populations to 35,000.

★ Yours for the asking—facts and figures on Dorr Multdigestor design and performance.

DORRCO

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RESEARCH ENGINEERING EQUIPMENT

ADDRESS ALL INQUIRIES TO OUR NEAREST OFFICE

At the CAMPS *as elsewhere!*

CHLORINATION RAISES THE *SAFETY RESERVE* OF SEWAGE TREATMENT PLANTS

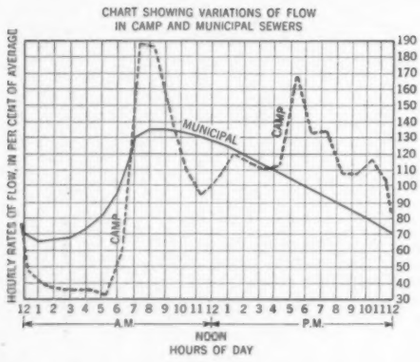
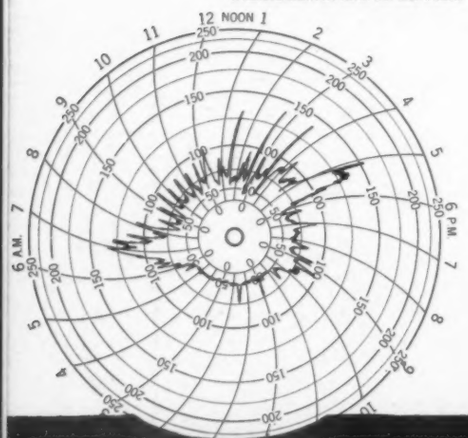


CHART SHOWING VARIATIONS OF FLOW
IN CAMP AND MUNICIPAL SEWERS
HOURLY RATES OF FLOW, IN PER CENT OF AVERAGE
MUNICIPAL
CAMP
CAMP
12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12
A.M.
NOON
P.M.
HOURS OF DAY

● *Typical variations in flow in camp and municipal sewage systems (from Technical Bulletin "Sewage & Incineration"—U. S. War Dept.).*

● *Chlorine flow for final sterilization at a U. S. Army Camp where W&T Chlorinators are in service.*



SEWAGE FLOW at military camps has sharper peaks and follows a different pattern from that of municipalities, but it confirms the same important fact: *The safety reserve to meet sudden changes and other operating emergencies goes up when modern chlorination facilities are an integral part of the treatment plant.*

Properly applied, chlorination can do a great deal more than provide a safe effluent. It can overcome odors and septic sewage, eliminate foaming and filter ponding, s-t-r-e-t-c-h the effective capacity of the plant. And with the right kind of control, chlorine is saved by eliminating wasteful periods of over-application.

W&T Chlorinators meet the needs of all types of sewage treatment plants. Application may be controlled manually, automatically (proportional to flow) or on a programmed "step-by-step" basis. And with W&T *potential chlorination,* changes in both strength and flow of sewage are instantly met with proper changes in the application rate.

When designing new sewage treatment plants for civilian or military use, or when seeking a way to make present plants fulfill today's unusual demands with an extra safety reserve ...it will pay you to secure the experienced aid of your Wallace & Tiernan Representative.

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